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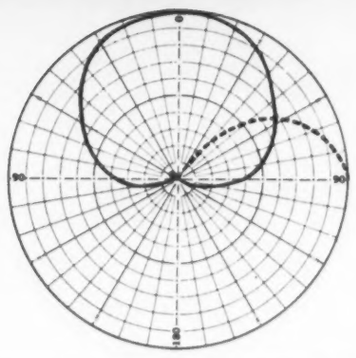
Granger Associates / Translating radio theory into practical radio hardware



Azimuth and elevation radiation patterns of G/A Model 726 vertically polarized monopole log-periodic (picture above). VSWR of 2.1:1 (nominal). 10 db gain.

THE H-F COMMUNICATION ANTENNA THAT CAUSED A REVOLUTION

The h-f log-periodic antenna has opened the door to a new era of truly high-performance h-f communications systems. In service now, Granger Associates' log-periodics provide performance unattainable with today's rhombics. Specifically: useful band-widths up to 16:1 (the best rhombics are limited to 2.5:1); comparable gain in one-sixth the real estate; high efficiency (no resistors!); no significant side lobes (high gain rhombics radiate in a half dozen directions); take-off angle independent of frequency. More than three years ago, Granger Associates recognized the importance of the log-periodic antenna to h-f communications. We set out to master it. Today, sound structural designs of our long-haul and short-haul log-periodics are in quantity production. They function reliably in abusive environments for major customers. The quality of their materials, components and fabrication equals their remarkable electrical performance. A new G/A technical staff study explains how to specify h-f communications antennas. Another report describes G/A's ionosphere sounder (instantaneous measurement of optimum working frequency). May we send you copies of both?

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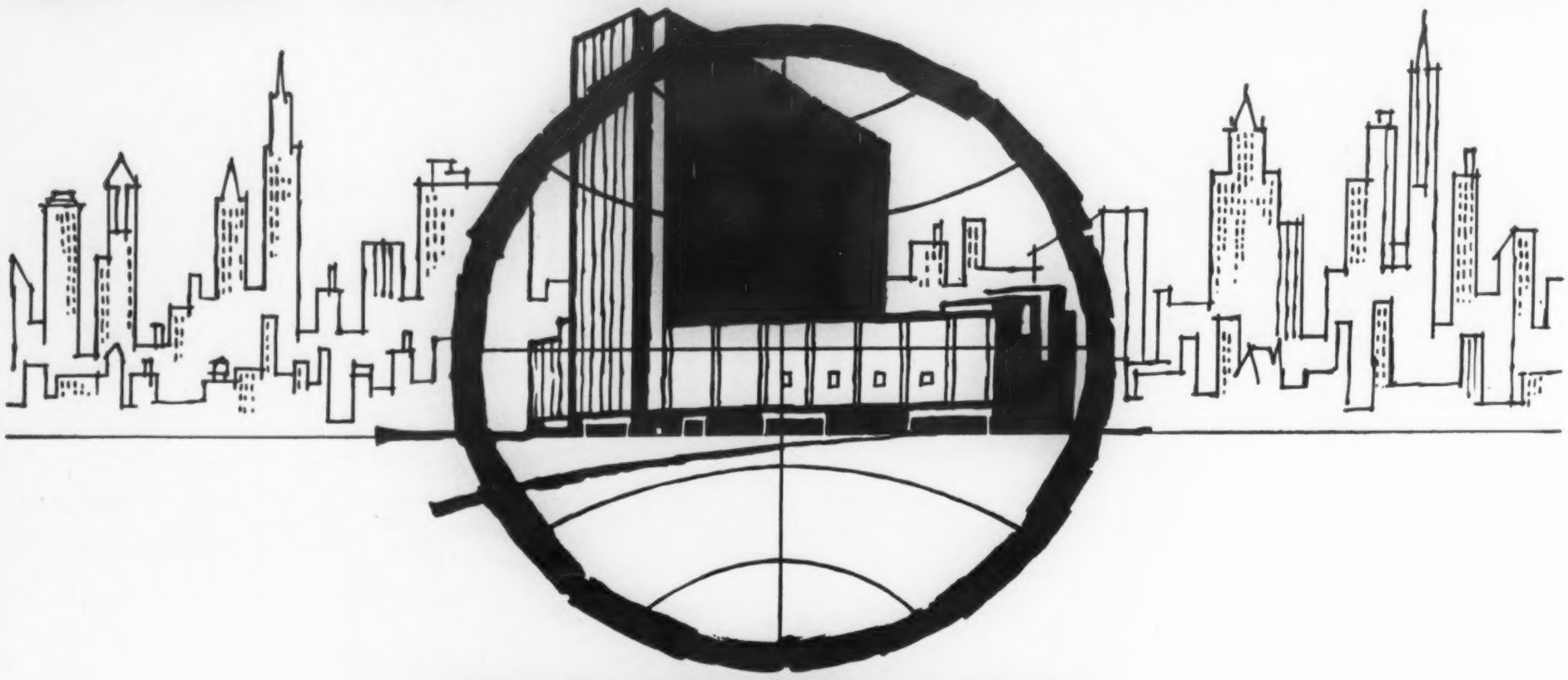
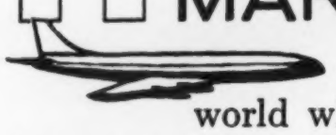


INTERNATIONAL CONVENTION □ □ AND IRE SHOW

□ □ MARCH 20-23 □ □



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No one under 18 years of age will be admitted.

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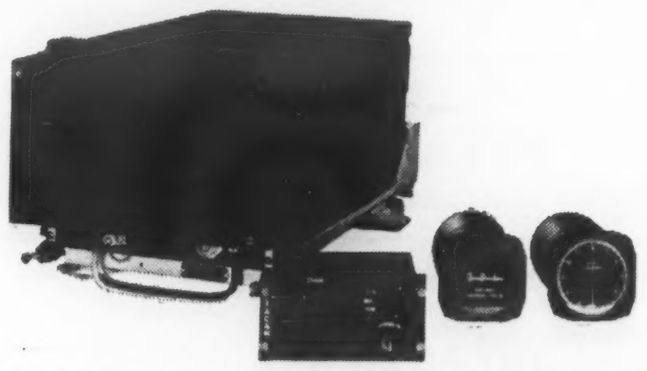

NOTE:—This same system is custom-packaged with interchangeable modules for F-104, T-38, B-58 and XB-70 airplanes.

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who?

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THERE'S ONLY ONE ANSWER TO ALL TEN QUESTIONS

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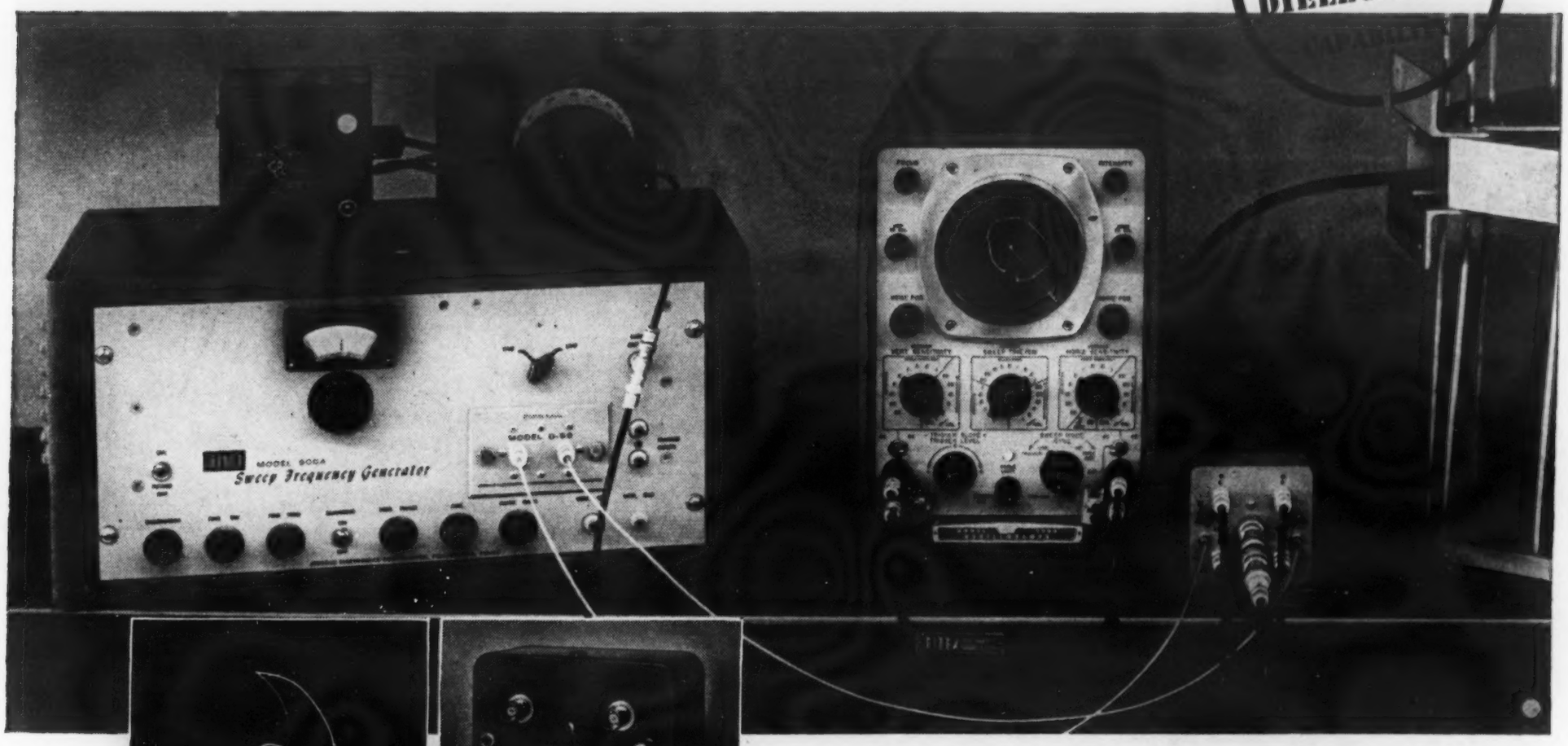
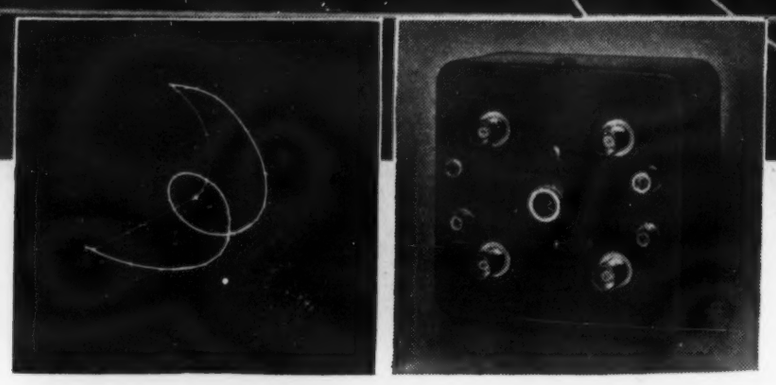
Pioneering in outer space to improve communications on earth

The best way yet to measure complex impedances

ANOTHER MEASURE OF DIELECTRIC'S





Here — for the first time — is an approach to the measurement of complex impedance over a band of frequencies that, for speed, simplicity and reliability, surpasses anything yet used.

It's the Smith Chart Plotter, specially developed by Dielectric Products Engineering Company to obtain instantaneous display of impedance as a continuous function of frequency. There are five coupler models spanning 10 to 3000 mc/s.

This unique coupler — along with appropriate auxiliary equipment to form the complete plotter — eliminates the need to tie up highly skilled technical personnel during prolonged test routines that characterize slotted line measurements. As precise as it is versatile and easy to operate, the Plotter functions simply and quickly to deliver peak accuracies.

HOW IT WORKS

With Dielectric's Smith Chart Coupler, a sweep generator sweeps over the frequency band of the unknown load. A continuous trace of impedance versus frequency is displayed directly on the Smith Chart faceplate. This can be either a full scale chart or one expanded to 1.5:1 VSWR. As adjustments are made, impedances change as does the corresponding trace. Since the Plotter is direct viewing, load changes can be observed immediately. When a permanent record is required, the oscilloscope trace may be directly photographed. Or, if preferred, an X-Y chart recorder may be used.

If you're a designer looking for a faster, easier way to obtain more accurate impedance and admittance measurements of diverse components such as antennas, filters, load resistors, transformers and other r-f networks, you'll find the Smith Chart Plotter one of your most essential tools.

For complete description and for details of operation of the Smith Chart Plotter, write for Bulletin 60-3.

SPECIFICATIONS (ALL MODELS)

Nominal impedance	50 ohms
RF input voltage	0.2 volts, rms
Oscillograph signal voltage (0.1 volt input to plotter)	40 millivolts x reflection coefficient
Accuracy of reflection coefficient measurement	
a. Amplitude	± 5% of reflection coefficient ± 0.01
b. Phase	$\pm$ 3 degrees $\pm$ arc tan $\left(\frac{.01}{\text{reflection coeff.}}\right)$
Sweep rate (maximum)	60 sps
Spot rotation rate (maximum for full accuracy)	1000 rev/sec
RF input and output terminals	Type N female
Oscilloscope signal terminals (balanced)	Type BNC female
Automatic level control terminals	Amphenol Series 27 female

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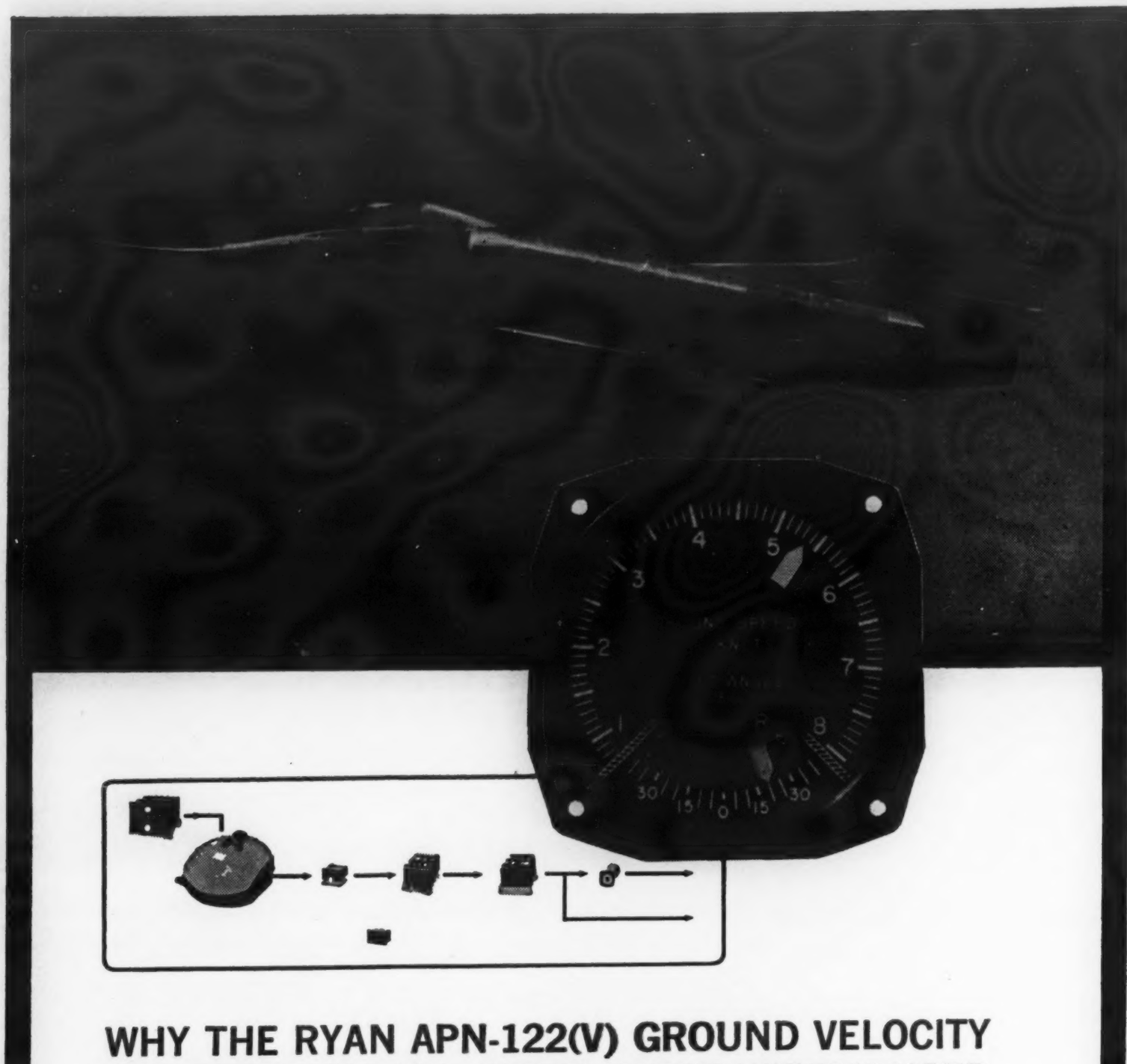
See the Smith Chart Plotter in operation during the IRE Show, Booth 2004.



WHY THE RYAN APN-122(V) GROUND VELOCITY INDICATOR IS THE FINEST, MOST WIDELY USED DOPPLER NAVIGATOR IN THE WORLD

Adaptable for nearly every type of aircraft, the Ryan APN-122(V) continuous wave Doppler system provides instantaneous and continuous display of ground speed and drift angle *in all weather* without reliance on ground or celestial aids. Here are some of the advantages that make this Ryan radar system the most advanced, *proven* means of aerial navigation.

- Ryan APN-122(V) is **qualified,** thoroughly **proven** in flight and **in full production.**
- Meets MIL-T-5422D and MIL-E-5400C specifications.
- Has no altitude or attitude holes.
- High accuracy (within ½%) at all altitudes from 0 to 70,000 feet, and over seas even smoother than Beaufort 1.
- No minimum altitude. Operates during take-offs, landings and turns.
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APPLICATIONS OF RYAN APN-122(V) NAVIGATOR

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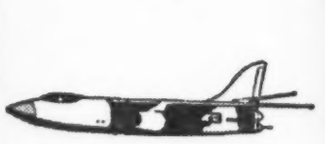
AIRCRAFT ALREADY USING RYAN APN-122(V) NAVIGATOR

A2F W2F

R5D



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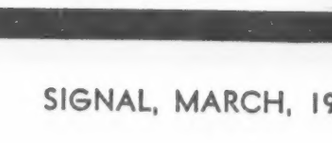

P2V

WV-2E

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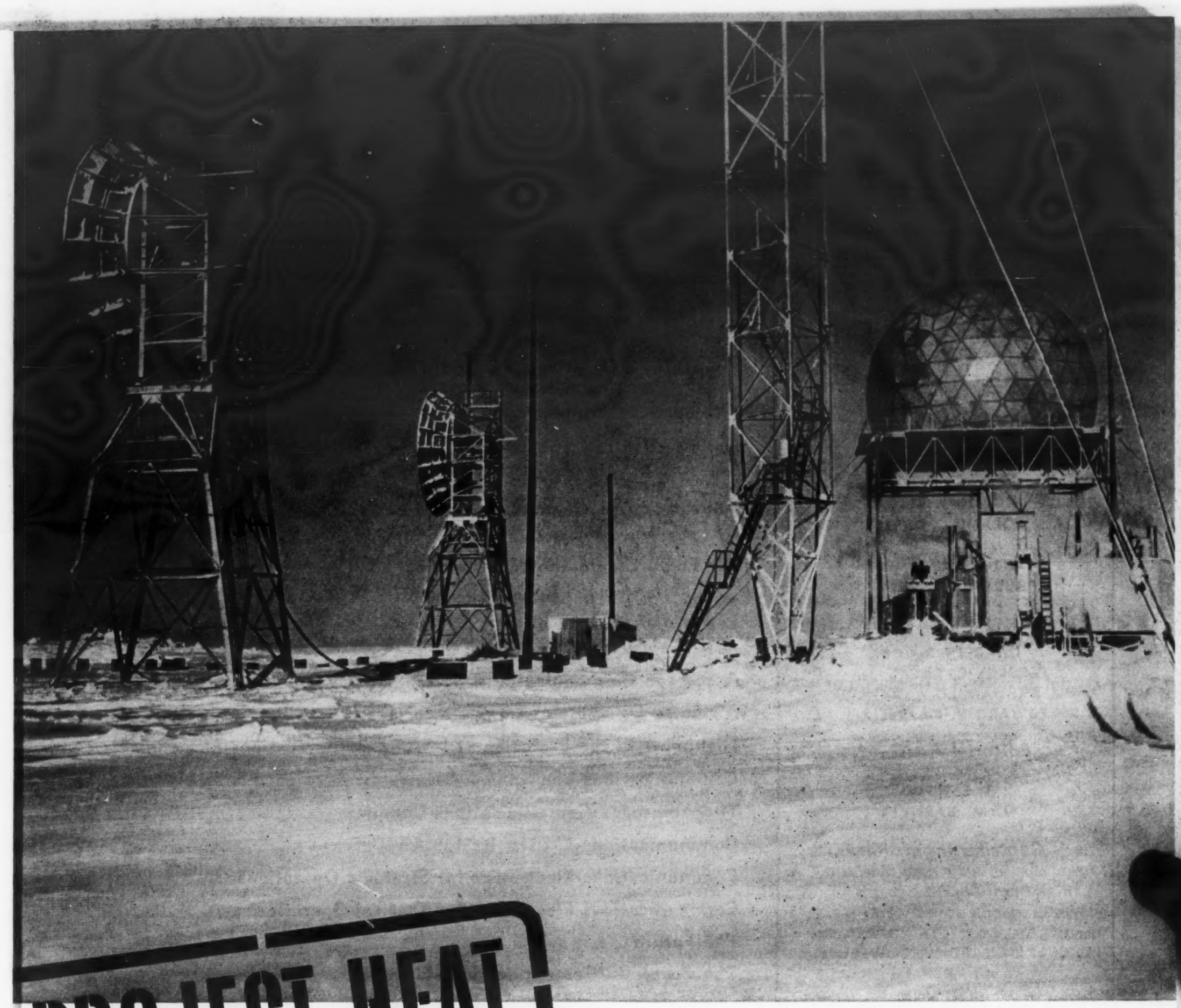

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SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XV **MARCH 1961** **NUMBER 7**

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COVER

MIDAS II (MIssile Defense Alarm System) is shown on the cover as it transmits information to earth. Project MIDAS is a U. S. Air Force research and development program designed to give the United States a military satellite system capable of detecting the launch of a ballistic missile seconds after it leaves the launch pad. The MIDAS satellite, using infrared sensors, detects heat radiating from exhaust flames of ballistic missiles. By telemetry, this data is transmitted instantaneously to read-out stations.

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SIGNAL is profoundly grateful to General Dynamics/Electronics, a Division of General Dynamics Corporation, for relinquishing its back cover for this special Air Force issue.

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BPA

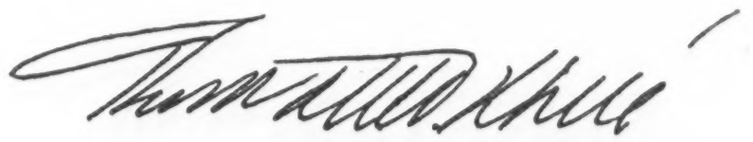
As YOU READ THIS MAGAZINE, military men are on combat alert at many points here at home and elsewhere throughout the world. Air Force Defense Command personnel are scanning radar screens, and interceptor pilots and missile crews are standing by in ready rooms. The Tactical Air Command's Composite Air Strike Force maintains a constant readiness to quickly deploy combat units anywhere they might be needed. Combat crews and missileers of the Strategic Air Command and our overseas tactical air forces are poised by their aircraft and missiles—also ready to respond to attack with speed and power. Similarly, Army men are standing watch at air defense installations and forward overseas observation posts while Navy crews are at battle stations on and under the seas. The trigger which will energize the timely and effective response of these forces to national policy is communications.

Advanced communications capable of meeting the extreme demands in speed and volume posed by modern military operations are mandatory if our military organizations with their fantastic new weapons, our instantaneous alert posture and the continuous combat readiness being maintained day in and day out, are to be truly effective—if ever called upon. And in the Air Force, our vast and modern communications network acts as the nerve system which binds our far-flung combat units into a single powerful integrated global fighting force.

Time—once our natural ally—is now working against us in some very vital areas—foremost among these are warning and control. Communist possession of jet aircraft and intercontinental ballistic missiles has made warning against such attacks an urgent and vital requirement for the survival of free world forces. In addition, we have a critical need for the proper command and control of our own forces and weapons. In this respect, the time available for commanders to make decisions has been radically reduced; concomitantly, the data to be processed for these decisions has increased in quantity and complexity. Since the competence of our combat forces depends to a large extent upon the speed and precision with which they can be launched and controlled, commanders must have instantaneous access to all essential information—and this information must be presented in such a manner that the right decisions can be made with a minimum of delay.

The successful implementation of proper warning and control depends primarily upon high speed, reliable, and secure global communication nets and data processing centers which can transmit, collect, collate, store, filter, and present in useable form the tremendous quantities of vital intelligence of all types. The Air Force has been constantly striving to improve communications for its far-flung forces, and today we are operating facilities whose extent and responsiveness is unparalleled in history. Nevertheless, in this era of dynamic technology we can never stand still—or rest satisfied upon past accomplishments. New media and new techniques for improved communications are rapidly appearing on the development horizon. These must be exploited with imagination and urgency by the scientific-industrial-military team. In this way, we can provide communications which will match the pace of the astounding new weapons now being—or soon to be—developed.

The security of our nation—and perhaps the entire free world—could well depend upon the reliability and responsiveness of our present and future communications systems.



GENERAL THOMAS D. WHITE
Chief of Staff, United States Air Force

★ ★ ★ ★

Air Force Communications Service

New Major Command of the USAF

MAJOR GENERAL HAROLD W. GRANT
Director of Telecommunications
United States Air Force

★ ★

As we go to press, National Headquarters of AFCEA received word of the selection of Major General Harold W. Grant to head the new Air Force Communications Service Command.

General Grant has contributed so outstandingly to communications and electronics in the Air Force that his promotion is in keeping with the best traditions of the service and is highly regarded by the entire membership of the Armed Forces Communications and Electronics Association. Our Association has come to respect General Grant for his sound leadership, his administrative excellence and his marked professional confidence. In recognition of this well earned honor, the Association joins in extending General Grant its profound congratulations.

It is our conviction that the following article by General Grant will provide a timely insight and understanding of the new Air Force Communications Service Command.
W. J. Baird, Editor

On 1 July 1961 the letters "AF CS" will take their place along with SAC, TAC, ADC, ARDC, AMC, MATS and the twelve other readily recognized abbreviations of Air Force major commands. For on that date AFCS—the *Air Force Communications Service*—with Headquarters at Scott Air Force Base, Illinois —will become the nineteenth major command of the United States Air Force.

To me the most exciting single element of AFCS is its newness; its new concept, and of particular importance, its new capability to meet the communications needs of an aerospace Air Force, now and in the future.

For this reason, in describing this new "product," my *first* impulse is to stamp the word "NEW" all over the "package" in large letters. But on second thought I must be cautious not to give the wrong impression, because it seems to me that there is scarcely a product on the market today which has not come out with a new model or version. And just "being new" can sound like the same old story.

At times, however, I read of a *really new* product coming on the market; a product which admittedly combines many of the familiar proved ingredients, plus many new elements, but "according to an entirely new formula."

Such a product is a *new entity* with its own distinctive identity. *And the strength and power of this type of new combination is greater than that of any of its original individual elements.*

As a new entity, AFCS will amalgamate the dynamic forces of communications experience, background and competence of today's AACS with these same dynamic forces of the separate commands, and will, thereby, be able to bring a new unified approach to the total Air Force communications requirement. Reporting directly to the Chief of Staff, USAF, AFCS will assume responsibility for operating the Aerospace Communications Complex—the Air Force's global system of communications. It will manage all major long haul circuits of the Air Force: point-to-point and air/ground telecommunications, plus the terminal and on-route navigational aids.

One of the key management advantages of this "single manager" concept is that AFCS will provide a single point of contact for the newly created Defense Communications Agency. There is no question in my mind but that this will insure the most efficient management of Air Force communications resources, in keeping with the spirit and philosophy of the Defense Communications Agency itself.

The need for an AFCS has been recognized for many years. It was studied at the Air University as early as ten years ago. As the technology of modern day communications developed there was an evident need for integration to insure technical compatability of hundreds of different types of equipment and systems —and to insure efficient, economical use of resources available. It was recognized early that as technical integration took place, integration of management could not be too far behind, and for the same reasons of economy and efficient management.

The Air Force Communications Service, as I have said, will provide that "management integration."

I hasten to point out, however, that in concentrating Air Force communications management in a single organization, the planners have not for an instant overlooked the necessity of AFCS to be immediately responsive to the separate needs of each of the separate commanders. Although

the details of organization are not yet final, I can assure the reader that the final AFCS will be responsive to individual commanders, while at the same time guaranteeing the integrity of a global communications system.

I mentioned that the need for an Air Force Communications Service has been recognized for many years. It is worth emphasizing that the establishment of AFCS on 1 July will not be a precipitous solution to this long-standing need. Actually, only now, after two years of testing in the Pacific and Alaska, and after the *continuous* development of the communications posture in response to changing Air Force needs, has the time been so right for AFCS to be established. As a matter of fact, the activation of AFCS really will be the *third* in a series of organizational steps taken by the Air Force to improve our communications system and its management.

The initial step was the establishment of a central communications and electronics procurement and logistics agency in the Rome Air Materiel Area, and the creation of the Ground Electronics Engineering Installation Agency (GEEIA) to accomplish all Air Force engineering and installation in connection with ground C&E equipment.

The second step was establishment of the Command and Control Development Division within the Air Research and Development Command, and the Electronics Systems Center within the Air Materiel Command, to permit development, integration and procurement of command and control systems under the management of single Air Force agencies.

AFCS, as indicated, will be the third step, when it comes into being on 1 July.

The development of AFCS will not be completed overnight. Purposely, the transfer of communications operating responsibilities from major commands and AACS will be time-phased. The completion date of the transfer is estimated to be 1 July 1963, thus allowing a full two-year period for orderly transition with minimum dislocation of personnel and units.

But the *concept* of the new AFCS will begin to take hold one minute after AFCS is established. It is a bold, challenging management concept which will pay big dividends—in operating efficiency for the aerospace Air Force, in savings, and in providing even greater opportunity for a growing professionalism in the communications-electronics career within the Air Force.

General Thomas D. White, Air Force Chief of Staff, listed "an improved system of communications" as one of his ten most important developments required by the Air Force today. The Air Force Communications Service — AFCS — will play a major role in providing that improvement.

LETTER OF APPRECIATION

This special Air Force issue of SIGNAL Magazine not only captures the imagination but also indicates clearly the prodigious effort which has gone into its composition and production. While it represents another hallmark in SIGNAL's accomplishments, it indicates, more precisely, our Association's endeavor to develop a reservoir of knowledge in those areas of military communications and electronics essential to a broader understanding of our civilian-military team concept.

In March 1959, SIGNAL Magazine featured the U. S. Army Signal Corps' Component issue and in April 1960, the special Navy Communications issue. Now, the Association is privileged to introduce its special Air Force issue on the importance of communications and electronics in the Aerospace Age. These special issues have provided a healthy climate for an insight into the Armed Services' contributions to our national welfare.

As the National President of AFCEA, I commend most highly the United States Air Force and all those who have contributed so much toward this accomplishment. The entire membership of the Armed Forces Communications and Electronics Association joins with me in extending this tribute of appreciation.

B. H. Oliver, Jr.
National President, AFCEA
Vice President Upstate
New York Telephone Company

OUR AEROSPACE FORCES have fifteen minutes to be on their way. Communications has ninety seconds to tell them to go . . . this is USAF Aerospace Communications-Electronics today!

In two decades, communications, long a key to command, has become a vital key to our national survival.

There were hours of confusing reports immediately after Pearl Harbor, and more than a full day passed before Congress declared war. Months went by before we could effectively meet and counter the threat to this nation.

Now we must be prepared to launch our alert forces in a matter of minutes. To delay for months, days, hours, or even minutes, might mean destruction of the Free World.

1961 seems more than just twenty years from 1941, when we look at the aerospace task of today. With the jet bomber and intercontinental ballistic missile, we are now in an era when an enemy can attack us suddenly and directly, with little or no warning. And we must be able to weather the attack, if necessary, in sufficient strength to strike back selectively and decisively against the enemy military forces that could otherwise destroy us.

Here, in short, is what 1961 and the ICBM require of communications: Reports of enemy actions must be made in seconds. Our offensive and defensive forces must be alerted and on their way in minutes. Buildup time? None! Our forces must be immediately responsive to command and control at every instant in time and at any point in the world.

To provide Aerospace Communications in 1961, then, is big business. It is "big" because the Air Force—which communications must link for command and control—is really big. Capsulized, the Air Force looks like this to a communications-electronics planner:

> More than 800,000 officers and men, in eighteen major commands, dealing in offensive and defensive operations, air traffic control, weather, procurement and supply, research and development, training, transportation, administration, missile and aerospace craft launching, testing and tracking—scattered at more than 3800 installations throughout the world.
>
> 104 types of aircraft in the current inventory performing multifarious operational and experimental types of missions—from routine training to cargo carrying, to long range bombing, reconnaissance, electronic countermeasures, intercept, refueling and capsule recovery, and experimental flights at unprecedented speeds and altitudes.
>
> Missiles—Atlas, Titan, and Minuteman—operational, or scheduled to be operational, by 1962, all across the country; plus a nationwide force of Minuteman missiles on roving railroad cars by 1963 . . . Mace, Matador, Sidewinder, Bomarc, Hound Dog and more.

To satisfy these operational demands, AF military communications-electronics today has grown to be more extensive than any other single military or commercial communications system known to the Free World!

Here then is a micro-miniature montage of Air Force Aerospace Communications-Electronics, 1961:

> Forty million printed messages yearly—500,000 miles of wideband channels—five million miles of leased lines—90 million punch cards transmitted annually for logistic support of dynamic aerospace readiness—Midas, BMEWS, DEWLINE, Texas Towers, Airborne Early Warning—sixteen per cent of all Air Force personnel, or 125,000 people—practically every type of ground and airborne communications-electronics equipment available today, employing every mode of transmission and reception, in frequencies across the entire radio spectrum and beyond—all of which take one-sixth of the Air Force budget, a dollar figure today which represents a 1000% increase since 1950.

And as the responsibilities of the Aerospace Age continue to expand, so will the requirements of aerospace communications-electronics . . . for Skybolt, B-70, Dynasoar, Samos . . . and on into space.

Today, almost every U. S. space activity necessarily involves the Air Force, or is based largely on developments arising from Air Force requirements. The reason for this is two-fold: (1) What is known as "space" is only a continuation, without any dividing line, of the operational medium in which the Air Force has specialized from its beginning. (2) The Air Force has been charged with the responsibility of conducting the primary "offensive and defensive air operations" for our Nation since 1947 and has been assigned the primary function of providing forces "to gain and maintain general air supremacy."

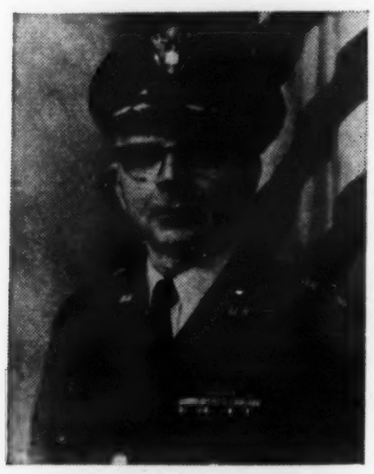
In fulfilling these responsibilities the Air Force must operate at *any distance from Earth permitted by state-of-the-art in aeronautics and astronautics and made necessary by the performance capabilities of any potential enemy*. The Air Force, therefore, considers gaining and maintaining general aerospace supremacy its primary function.

Aerospace communications-electronics, therefore, must keep up, expand and diversify to provide speed, capacity, reliability and survivability wherever and whenever aerospace operations take place.

AIR FORCE DIRECTORS OF COMMUNICATIONS

PAST AND PRESENT

Major General Harold W. Grant
Director of Communications-Electronics
1958-1960
Director of Telecommunications
1960 to date



Maj. Gen. Alvin L. Pachynski
Director of Communications-Electronics, 1956-1958

Maj. Gen. Gordon A. Blake
Director of Communications-Electronics, 1953-1956

Maj. Gen. Raymond C. Maude
Director of Communications, 1951-1953

Maj. Gen. Francis Ankenbrandt
Air Communications Officer, 1945-1947; Director of Communications, 1947-1951

Maj. Gen. Harold M. McClelland
Air Communications Officer, 1944-1945

Brig. Gen. Alfred W. Marriner
Air Communications Officer, 1936-1938; 1941-1944

Brig. Gen. Wallace Smith
Air Communications Officer, 1938-1941

Col. William B. Souza
Air Communications Officer, 1934-1936

Brig. Gen. Jacob H. Rudolph
Air Communications Officer
(As Major—1930-1933)

Maj. Gen. St. Clair Street
Air Communications Officer
(As 1st Lt.—1925-1927)

Capt. Burdette S. Wright
Air Communications Officer, 1921-1925

Col. Clarence C. Culver
Air Communications Officer,
(As Major—1918-1921)

COMMUNICATIONS-ELECTRONICS systems of the future will evolve from the developments of the present, just as today's systems evolved from the past.

Until well into the nineteenth century, no significant advance in the speed or range of communications had been made. Messages were either sent by visual means—smoke signals, heliograph, semaphores, signal lanterns—or carried by men. Control of military operations, particularly over any distance, was difficult; frequently coordination was poor.

Even the invention of the telegraph and telephone did not greatly speed up battlefield communications, and during World War I military commanders continued to rely heavily on visual signals and on dispatches that could be carried by men or sent by homing pigeons.

World War I also saw the use of two inventions that had appeared about the turn of the century, the airplane and the radio. The first made possible a whole new dimension of mobility, and the second complemented this mobility to provide a degree of coordination and control never before possible. The marriage of the airplane and the radio foreshadowed the development of the aerospace forces of today.

The airplane and the radio grew up together. In 1909 the military acquired its first airplane; a year later the first message was sent by radio-telegraph from a plane to a receiver on the ground. In 1911 a group of planes was directed in formation by radio-telegraph. The next few years saw the development of two-way ground-to-air communication and air-to-air communication. By 1917 radio-telephones for aircraft were in production, and shortly before the end of the war they were beginning to arrive overseas in quantity.

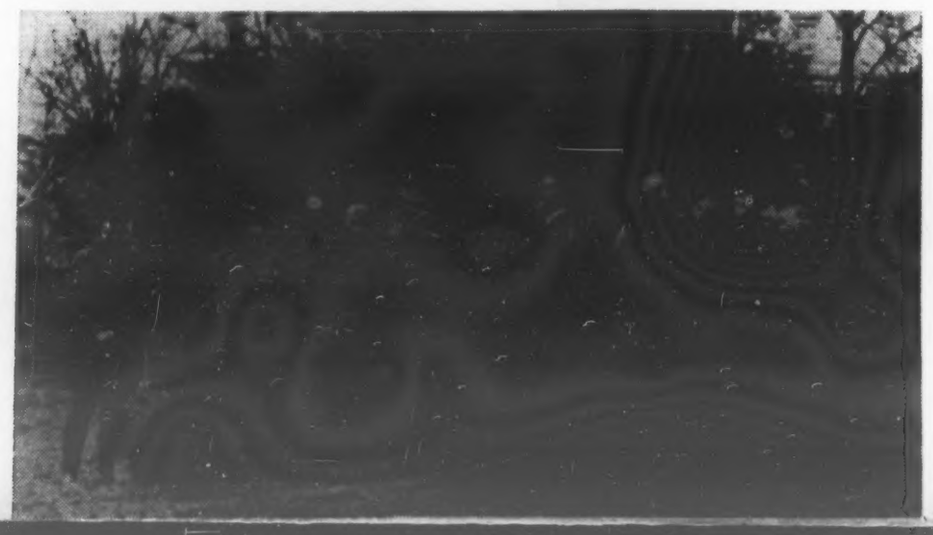
At first, airborne radio was regarded as an exciting invention that could very likely be useful to the new and growing Air Service; now, global communications for command control of aerospace forces is essential.

The impetus for a special communications system in support of air operations came in 1934, when General "Hap" Arnold, then a lieutenant colonel, led a flight of ten Martin B-10 bombers from Washington, D. C., to Alaska and back again. Communications officers along the way had made careful advance preparations, and as a result the flight was never out of contact with communications stations on the ground. Information on weather and local conditions was continuously available, and accurate orientation virtually eliminated the margin for error in navigating across the wilderness of the northwest.

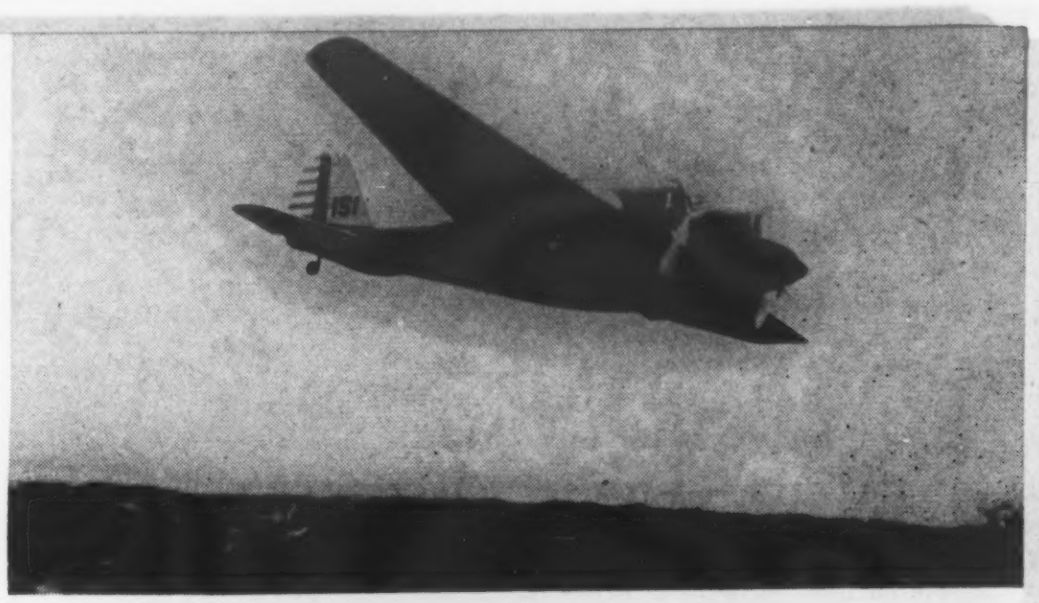
A short time later, General Arnold led another flight of Martin bombers, this time on a routine training mission. Because of bad weather and uncertain communications, the flight encountered a series of misadventures, inconveniences, and annoyances. Immediately General Arnold began the campaign for the development of an integrated communications system suitable to the needs of military aviation. As a result, the Army Airways Communications System, the forerunner of the present Airways and Air Communications Service (AACS) was established in November, 1938. (AACS will be incorporated into the new Air Force Communications Service on 1 July 1961. See article, page 20.)

World War II brought new advances in Air Force communications-electronics. The war encouraged the development of radar, which had been the subject of British experiments in the 1930's, and it stimulated the full development of the guided missile, a weapon foreseen as early as 1914, when John Hays Hammond, Jr., filed a patent application for a "system of controlling an airplane or aircraft at a distance by radiant energy."

Until about ten years ago, these and other technological developments merely added to Air Force communications-electronics capability, but by 1950 the character of weapon systems began to change radically and rapidly. Prior to this time the relationship of communications-electronics to the weapons of war was primarily of a supporting nature. Now, however, communications-electronics has reached the point where it is an integral part of the weapon system and is indispensable to the now routine Air Force operations such as ICBM launch control, air weapons control, flight control, navigation, weather forecasting, maintenance and supply. But its primary importance is to enable the Air Force to go to war on a few minute's notice, and to provide the means for directing the offense and defense until the war is won. The far-flung radar networks that provide early warning of aircraft or missile attack, the computer systems that are needed for control of the aerospace battle, the widespread communications networks that carry the necessary word of command—all these have grown to be an integral part of today's aerospace strength.



President Wilson talks to airplane pilot by wireless telephone on Nov. 21, 1918. Colonel Culver (see p. 13) is on President's right.



A Martin B-10, of the type Arnold's group flew to Alaska in 1934. Even then, increasing speed of aircraft indicated need for rapid, efficient communications. B-10's top speed: 212 mph. Today's B-58 speed: 1425 mph.

Lt. Col. Henry H. Arnold, commanding a flight to Alaska, receives the key to Fairbanks. It was on this flight that Col. Arnold saw the need for a communications system to serve the special needs of the Air Corps. Destined for greater responsibilities, General Arnold was the first and only airman to obtain Five Star rank.

AT ANY GIVEN INSTANT approximately 1,000 USAF aircraft are flying somewhere in the world. Missiles are at the ready in silos or on launching pads, satellites are being tracked in orbit, hundreds of USAF bases are throbbing with a thousand sounds; a million and a half supply items—parts for missiles and aircraft and everything else the Air Force uses—are moving, being ordered and inventoried; thousands of airmen are working in hundreds of places, from the frigid north to tropical climes, from lonely mountain tops to metropolitan centers, across the continents and the oceans of the world and in air above; directives are being issued, inquiries and answers going and coming, streams of statistical data being compiled and transmitted; men peer into radar scopes, giant search and warning antennae hum their interminable vigilance, generals turn to check global maps. And permeating this dynamic, vibrant anatomy of aerospace forces are the millions of spoken, written, or encoded "messages" by which these world-wide actions are controlled.

Before, during, and after any one of the thousand aircraft roars from its runway, operational messages telling of its departure, route, and destination must be dispatched.

As the aircraft accomplish their respective missions, they bring into play a wide range of communications and electronics facilities. Over air-to-ground equipment pilots call ground stations below, reporting progress and requesting information about the weather and other matters affecting their flights.

Some of these aircraft may be tactical fighters, enroute across an ocean on a non-stop flight. As they contact check points—ships below, islands along the way—they confirm that headings and positions are correct.

Some of the thousand aircraft are part of SAC's forces. Many of them will depend on the penetrating eyes of airborne radar to bring them to rendezvous with refueling aircraft. Over air-to-air radio equipment they can converse with the refueling crews if necessary during training missions. Through airborne communications equipment they have the means to contact SAC headquarters directly or through ground relay stations.

Some of these thousand aircraft are interceptors of the Air Defense Command. They talk to ground radar stations, operations rooms, other aircraft, and are in touch with their combat control centers. These control centers are in contact with NORAD Headquarters which, through a vast communications network, is kept informed of developments the length and breadth of a continent and beyond.

But this traffic is only part of the communications support given to every aircraft in flight. When pilots prepare for their flights in briefing rooms around the globe, they receive current operational data transmitted from many parts of the world, as well as the weather information directly affecting their missions.

Each airbase receives the information on which global forecasts were made through a world-wide weather service, tied together by the USAF Aerospace Communications Complex (AIRCOM). From large and small observing stations at some of the most remote places in the world, weather observations are transmitted over teletype circuits to all other stations and to weather centrals where global teletype forecasts are made. From these centrals, weather maps are sent to all using agencies via facsimile circuits. Weather maps from within the continental United States are received every twenty minutes, and those from Canada, Alaska, Japan, and other areas come in every hour. This weather traffic—7.5 million messages, or 1.26 billion word groups, per year—is so constant and so perishable that an entire network is reserved for its expeditious handling.

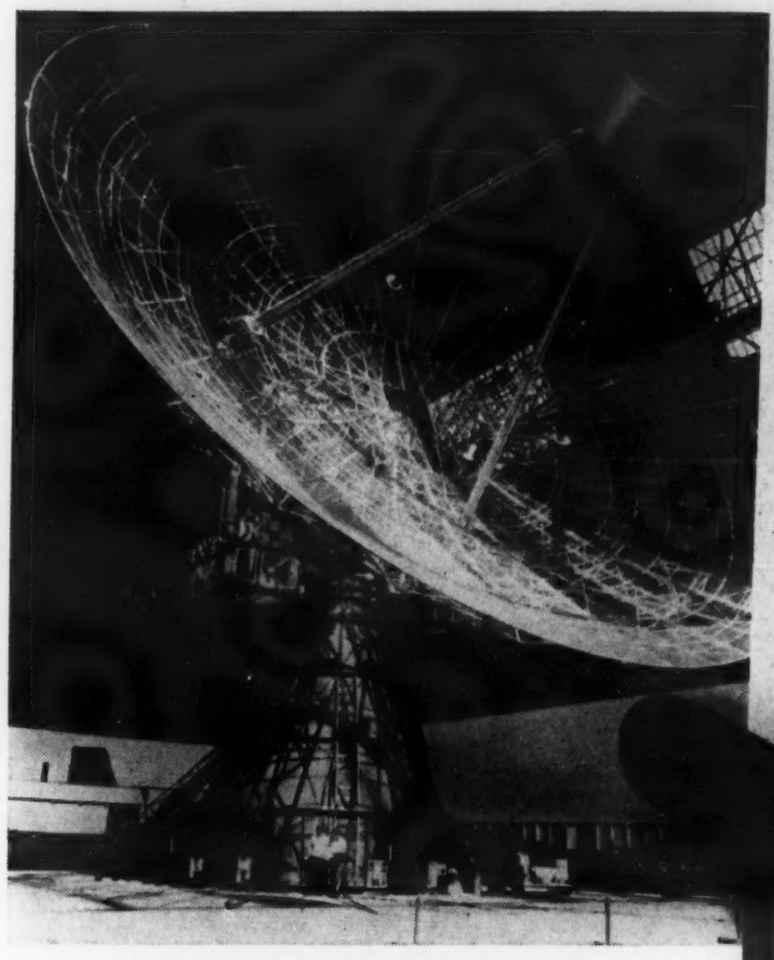
Still further back in time from the moment these aircraft take off, the communications system relayed data information in support of logistics. These encoded groups were transformed to punch cards (90 million in 1960) by which the supplies and parts necessary to keep the aircraft flying are ordered. If a spare part is needed for an aircraft (or a missile, or a radar, etc.) the request goes from the base to the central depot where the part is stocked. Sometimes these two points are separated by half the world, but where supply lines stretched for months during World War II, the time can now be cut to hours by a supply communications net known as the Combat Logistics Network, or COMLOGNET.

Communications-electronics is also necessary at the other end of the flight. Eventually every one of the thousand aircraft must land. As each one does, it brings into play terminal facilities which are aids to safe landings. These include various radio homing and marker beacons, tactical air navigation, ground control approach, instrument landing systems, radar approach control, and radar beacons, to mention a few.

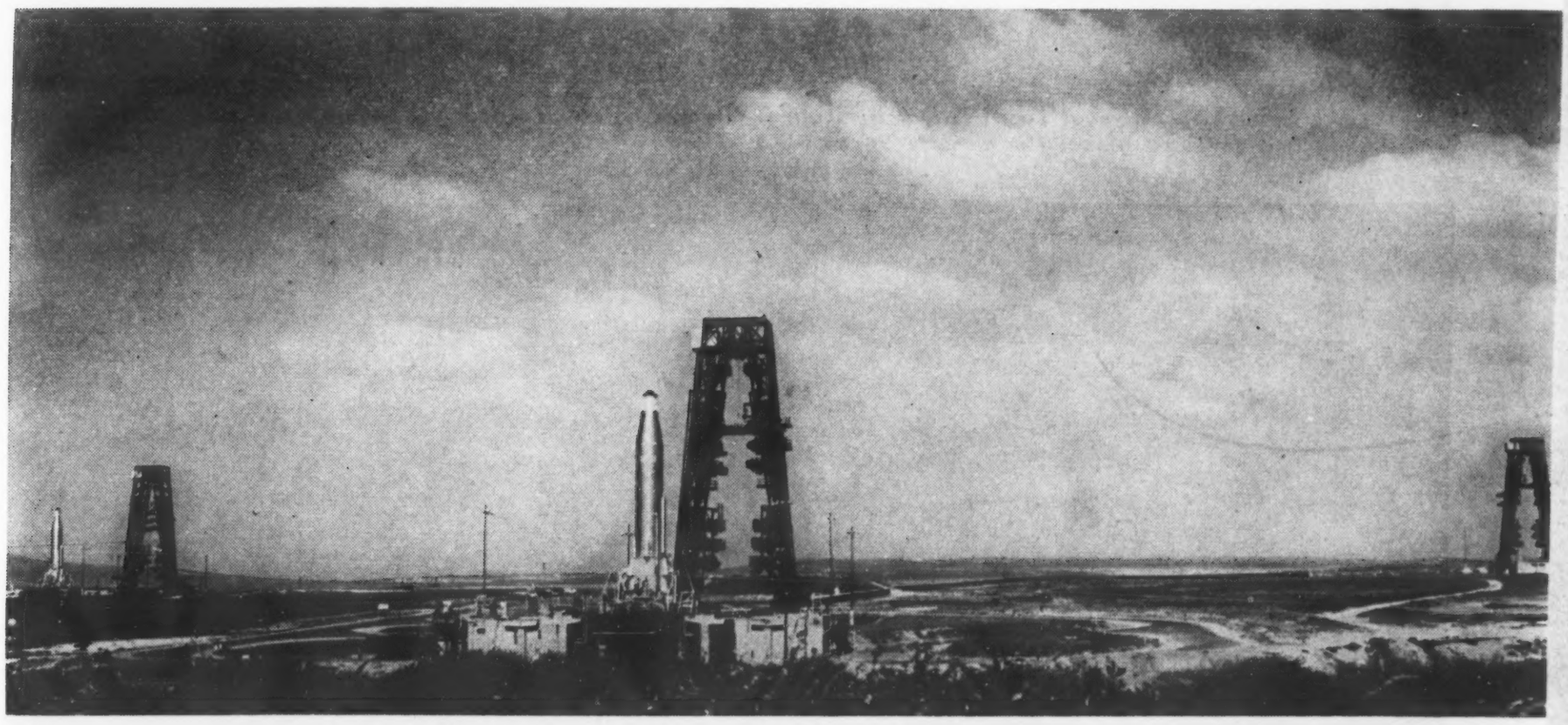
Through air-ground radio, the Mach 2 B-58 Hustler is in constant touch with command facilities of SAC.

Two of the Air Force's new F-105 Thunderchiefs, 1,400 mile per hour tactical fighters, depend upon electronics in making this refueling rendezvous.

Missile crews of the Strategic Air Command constantly improve their proficiency through continuing ICBM test launches.

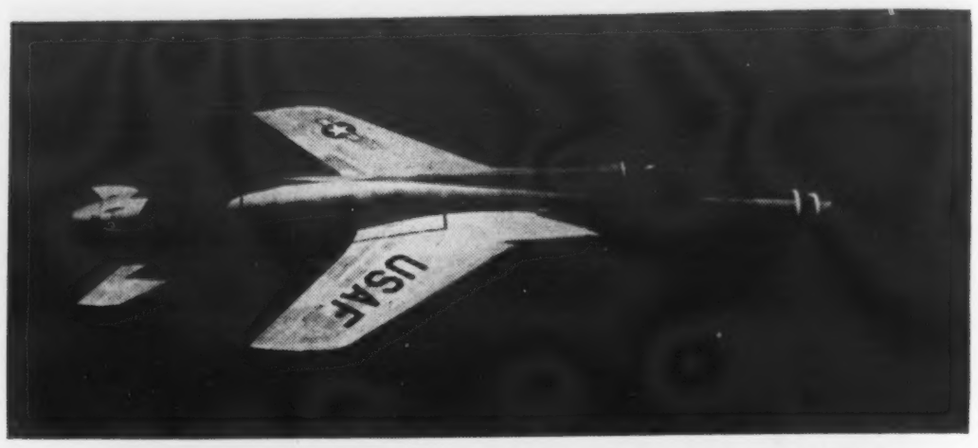


Tracking missiles is the task of this huge radar antenna being built for the Air Force's Ballistic Missile Early Warning System (BMEWS).



Widely dispersed launch pads of ICBM sites are tied together through the most reliable means of communications available.

Range of the B-52 is extended thousands of miles through its capability to refuel in mid-air from jet tankers. Radar enables refueling to take place in all forms of weather.



This F-105 tactical fighter contains a fully integrated flight and fire control system which enables its pilot to serve also as bombardier, navigator, gunner and radar operator. By pre-programming a flight into the electronic control system, a round-trip mission can be accomplished in any weather, without the pilot ever seeing the ground.

Through the Combat Logistics Communications Network, vitally needed parts—large and small—can be ordered and delivered globally in a matter of hours.

Voluminous, perishable global weather information is transmitted on a priority basis via AIRCOM facsimile circuits.

Information given air crews prior to each mission is received from all parts of the world.

In operations as vital as Ground Control Approach, new men are under the constant guidance of experienced people. Where the lives of trained aircrews are at stake, there is no room for error.

Control towers today rely on the latest radar, radio and other communications equipment, plus information from air traffic control and combat operations centers, to handle safely and efficiently the ever-increasing volume of aircraft arrivals and departures.

Safe landings depend upon reliable and accurate navigational aids, both airborne and ground. USAF aircraft are capable of 24-hour operations regardless of weather conditions.

THE AEROSPACE COMMUNICATIONS COMPLEX

THE AEROSPACE COMMUNICATIONS Complex (AIRCOM) handles all Air Force traffic. It is operated primarily by the Airways and Air Communications Service (AACS), an organization responsible for several thousand facilities at hundreds of locations all over the world. (See page 14.)

In addition to these facilities, the Air Force must also lease services and transmission lines from commercial sources for this operation.

AACS operates ten fully automatic message relay centers in the U. S., the Pacific, the Far East, and Europe as part of its world-wide facilities. Most of these centers can accept up to 200 messages simultaneously, segregate high from low precedence, scan one or more message addresses, route each message to the next relay point or transmit the message to its destination at speeds up to 100 words per minute. This speed is doubled for across-the-office delivery. This network alone handles well over 40 million messages a year.

Even so, these printed messages utilize only a fraction of the Aerospace Communications Complex. To enable our forces to go to war within fifteen minutes, the complex also must handle computer, facsimile, telephoto, and verbal data so that commanders may know the exact status of their own and allied forces—that is, status of missiles and aircraft, their immediate whereabouts, the readiness of crews and weapons, target assignments, and intelligence information vital to strategy and tactics. In fact, many circuits of the Aerospace Communications Complex are specifically allocated on a full-time basis to meet the requirements of certain operations and functions. These special circuits are linked together and referred to as networks. The names of the networks are representative of the functions they perform.

It can be said without hesitation that every activity of the Air Force has a "communications-electronics story" that should be told; a story that points up the dependence of every Command, in every mission, on communications-electronics. Yet, the full endeavor of all supporting commands is directed towards one Air Force objective—the preparedness of the Air Defense, Strategic, and Tactical forces. This calls for a closer look at the communications-electronics requirements of these forces.

Traffic coordinators continually monitor circuits and state of traffic within the fully-automatic message relay center—insuring smooth flow of traffic. These airmen have an extensive background in both communications operations and maintenance.

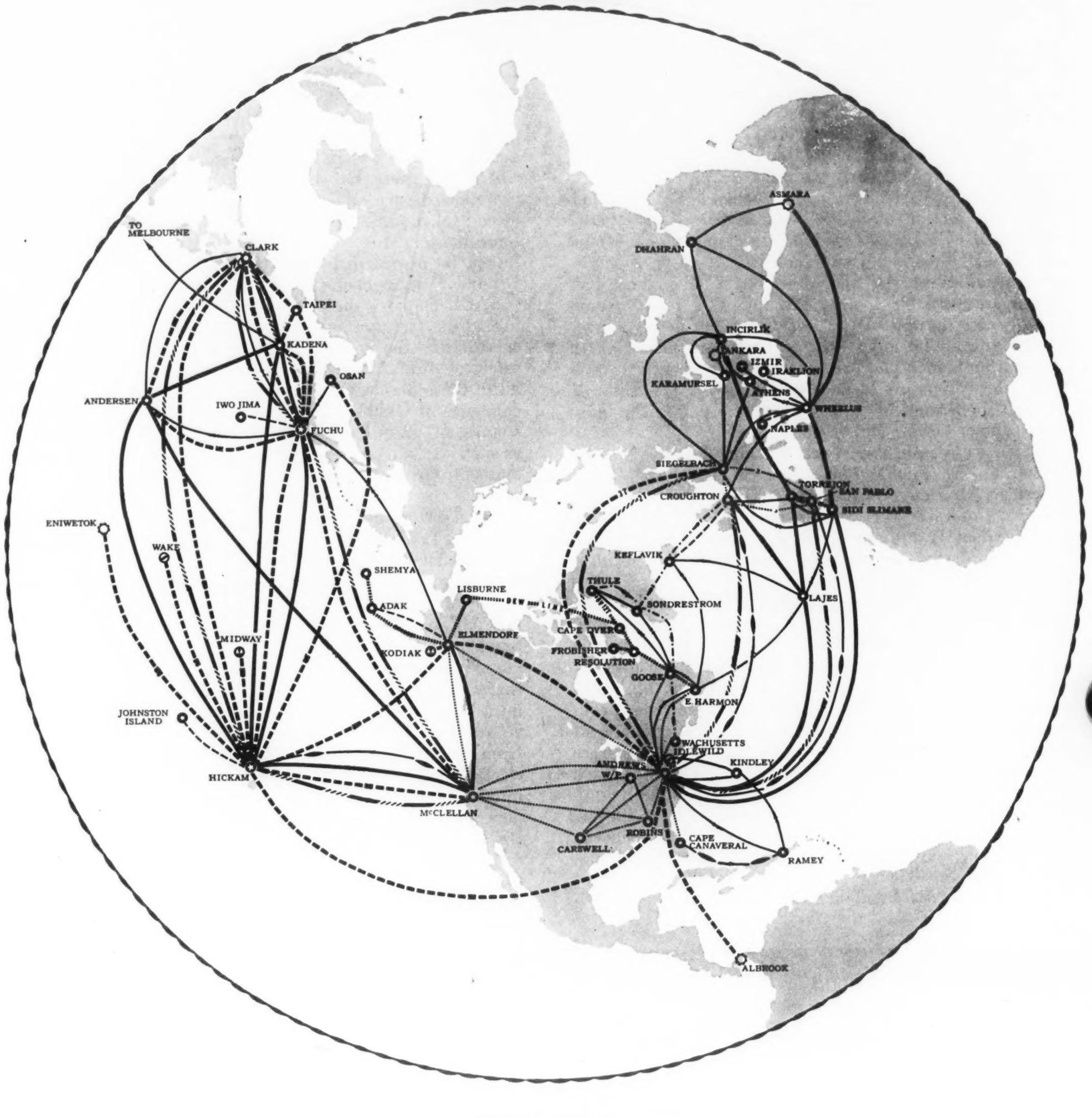
Automatic sending equipment is checked by airmen who monitor traffic during transmission to stations overseas and in the United States. Ten fully automatic relay stations of this type help make the Air Force telegraph system the world's most modern.

This control station of COMLOGNET receives supply requisitions from Air Force installations and relays them to appropriate depots. Supplies may then be air-lifted to the ordering agencies.

COMLOGNET data transceivers are used to relay logistical and statistical data traffic. Punch cards are processed at the rate of ten per minute. Ninety million cards were processed in 1960.

USAF AEROSPACE COMMUNICATIONS COMPLEX

(AIRCOM)



**** LEGEND ****

- SSB CIRCUITS
- MULTIPLEX CIRCUITS
- ALLOCATED FROM ARMY/NAVY/FAA
- LEASED RADIO
- SINGLE CHANNEL RADIO TELETYPE
- SUBMARINE CABLE
- LANDLINE
- FPTS
- FPIS

- AF AUTOMATIC
- AIR FORCE
- AF/ARMY
- ARMY
- FAA
- NAVY

COMMUNICATIONS-ELECTRONICS FOR AIR DEFENSE

WARNING AGAINST AN ATTACK on this continent by manned aircraft is provided by an extensive early warning system consisting of the DEWLINE, a chain of radar stations across the top of North America and Greenland—the Mid-Canada line, 600 miles to the South—and the Pine Tree line, extending along the U. S.-Canadian border—all augmented by picket ships, Texas Towers, and airborne early warning aircraft.

The need for early warning of enemy ICBM's has led to the construction of the Ballistic Missile Early Warning System (BMEWS) and the development of Midas infrared satellites. BMEWS consists of three gigantic radar installations, the first of which, in Greenland, has been operational since early last fall. Its radar beams sweep across the top of the world and can detect a missile as far as 3000 miles away. Should an enemy ICBM lift from its launch pad to arc toward America, BMEWS' electronic computers would calculate—at the rate of 200,000 mathematical operations per second—the missile's course, target, and impact area.

Information from these early warning systems is to be flashed to the combat operations center of the North American Air Defense Command (NORAD) at Colorado Springs, Colorado, for rapid evaluation. If warranted, the President is advised—strategic, tactical and defense forces are alerted and launched—and civil defense measures are taken.

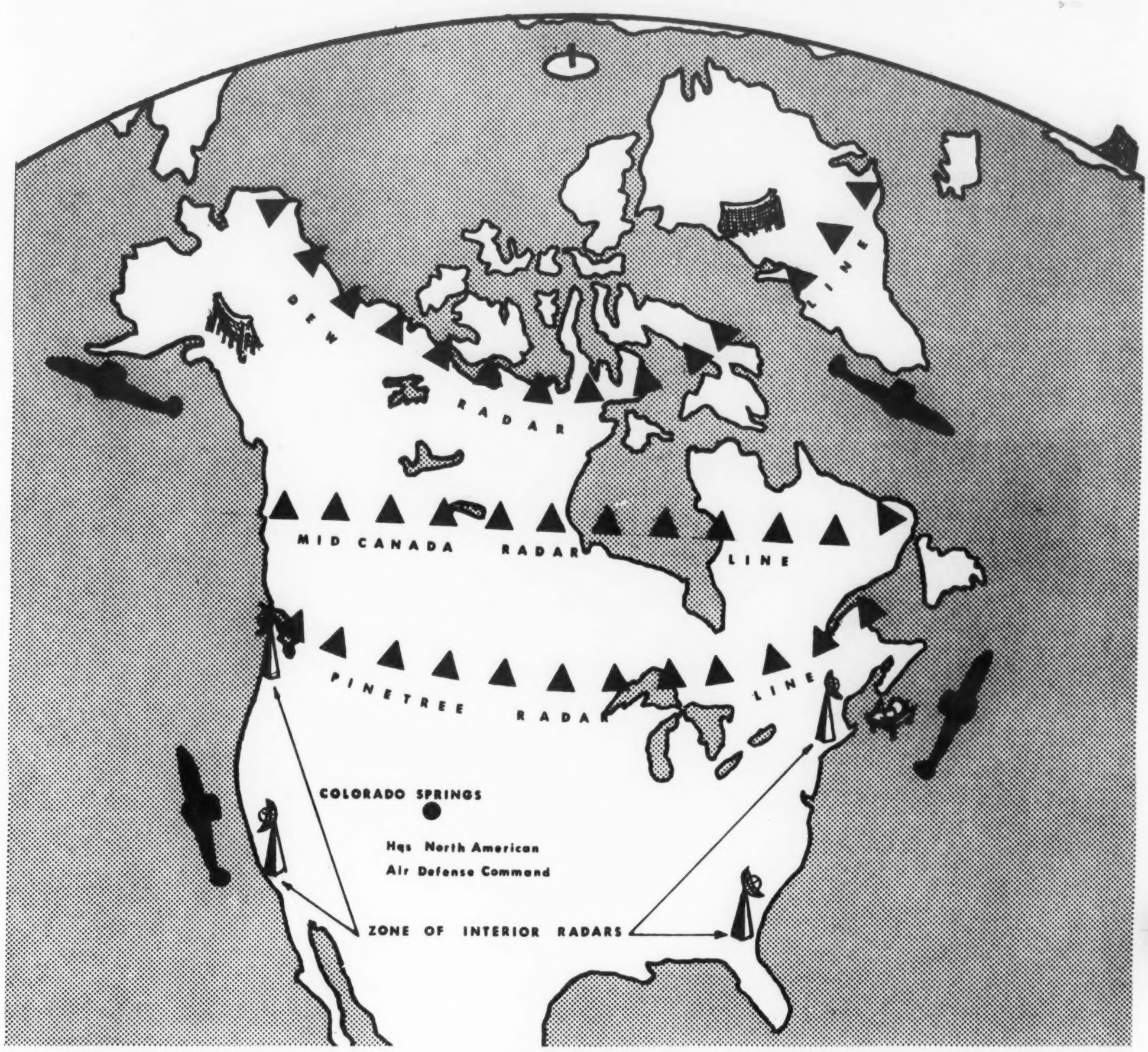
The transmission of data from BMEWS and DEWLINE sites to NORAD's combat operations center, however, faces certain difficulties. Communication in the Arctic is hampered by violent storms, magnetic disturbances, and static, which frequently blot out high frequency radio signals. In order to overcome these problems and ensure the rapid and accurate transmission of warning information, new methods of transmission were required. One of the methods used is FPTS (forward propagation by tropospheric scatter). This highly reliable wideband over-the-horizon propagation technique was first employed in the "Pole Vault" link between Stephenville, Newfoundland and Frobisher Bay, Baffin Island. The construction of this link resulted in one of the most dramatic breakthroughs of this decade in the art of communications. A system of ten stations was in operation 18 months after industry's engineers postulated that tropospheric scatter techniques could be employed for communication purposes. The design and construction of this system in such a short period of time was a tribute to the unparalleled efforts and cooperation of Canadian and U. S. military forces and civilian industry.

After warning has been given of an actual or suspected aerospace attack, some method must be employed to control the vast and incredibly complex aerospace defense battle. This control of the continental air defense forces is provided by the Air Force Semi-Automatic Ground Environment (SAGE) System.

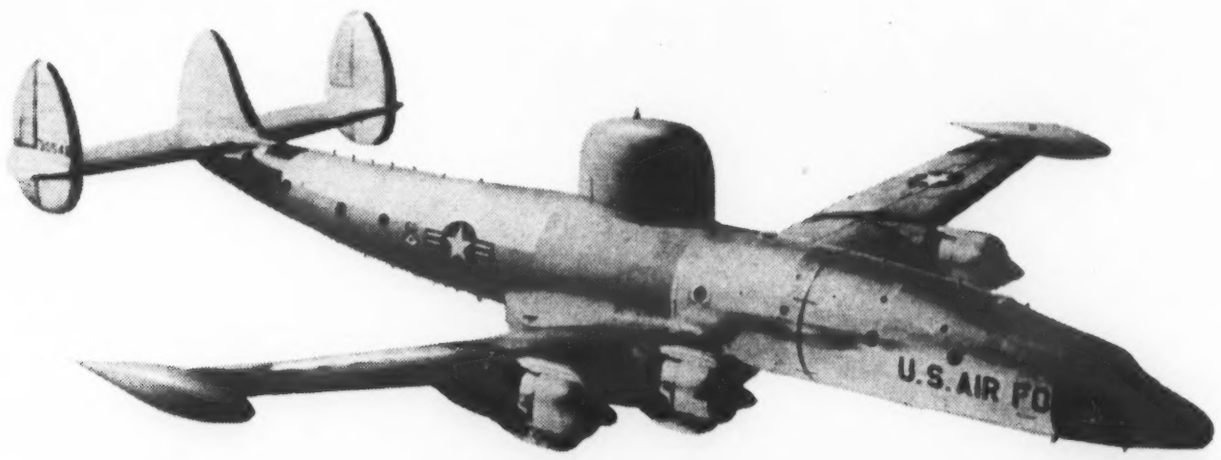
SAGE employs digital computers to analyze flight information from many sources, including the data received from the northern early warning systems. Thousands of aircraft fill our skies day in and dav out. For all of these flights, SAGE analyzes pertinent information, compares it with known and predicted flight plans, and sounds an alarm on those which are suspect. It can link as many as a dozen ground radar systems together automatically, process in microseconds the information these systems are receiving, transmit it from defense sector to defense sector, and present a comprehensive picture of the air situation over an extremely large area. And it can, as Air Force tests have shown, actually launch a Bomarc missile by remote control and guide it to intercept a target travelling at supersonic speeds.

SAGE, of course, does not function alone. All the communications-electronics facilities of the Air Force are geared to support the rapid response of the Nation's aerospace forces. In the event of an attack, these facilities must be able to relay warning and control information in *90 seconds*. In that first minute and a half, signals flash from BMEWS or DEWLINE sites to display centers where electronic data are evaluated by computers and converted into readable information appearing on scopes and panels for the single purpose of command decision. SAGE, DEWLINE and BMEWS, then, provide the communications-electronics base that ensures instantaneous, effective, and controlled employment of the Nation's defensive aerospace weapon systems.

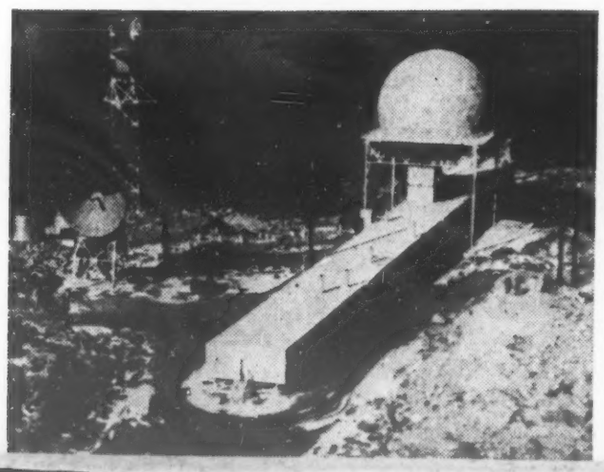
Air Force communications-electronics equipment is built to withstand the most severe operating conditions. Here an ice-laden tropospheric scatter antenna and the early warning radar in the background belie the unceasing activity of this arctic site.

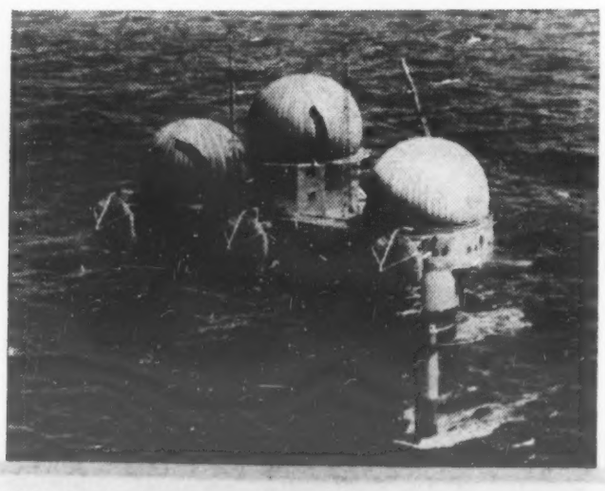


This artist's rendition of the North American early warning radar system shows generally how BMEWS, DEWLINE, the Mid Canada Line, the Pinetree Line and airborne early warning aircraft gird the approaches to our nation.



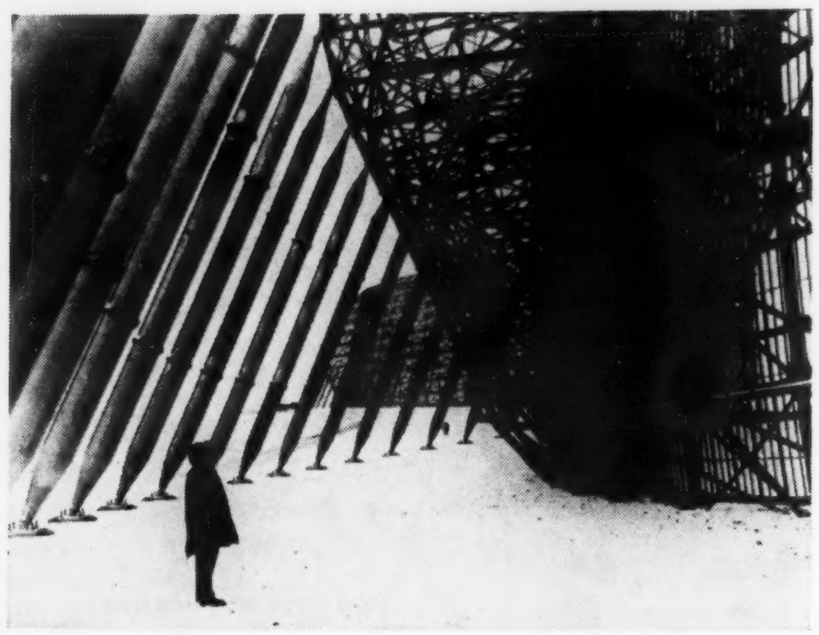
RC-121 aircraft like this patrol off-shore to provide seaward extensions of our early warning system.





(Left) This DEWLINE site is set among the rugged terrain of the high arctic. (Right) Looming out of the sea, 110 miles east of Cape Cod, Mass., is an early warning installation known as a Texas Tower.

To assure around-the-clock operation, engineers monitor the SAGE Computer Operating Consoles. These consoles show the operating status of the computer as it processes vital data in the ever-changing air situation.



(Above left) The chief of the weapons control team in the SAGE center is responsible for the control of defensive missiles and fighters during the air battle. Computers produce an analysis of the changing air battle; men make the decisions. (Above right) Legs of steel support BMEWS antennas.

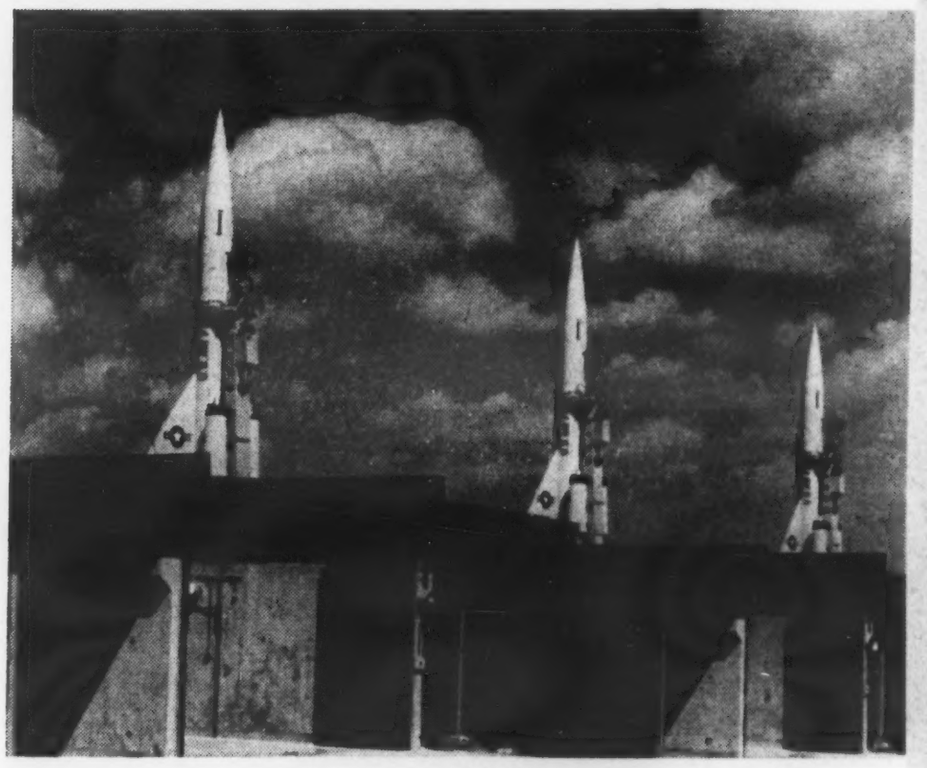
75° North is south of the operational BMEWS installation at Thule, Greenland. The other two sites, one in Alaska, the other in England, are presently under construction.

The Combat Operation Center of the North American Air Defense Command is the focal point for all vital air defense information. NORAD is manned by personnel of all the U. S. Armed Forces, members of the Royal Canadian Air Force, and the civil defense agency.

NORAD's Assistant Director of Operations is kept fully informed of the entire air defense situation, including unknown aircraft and missiles, throughout the North American continent.

NORAD's Space Surveillance Officer evaluates information received from the Ballistic Missile Early Warning System (BMEWS). The airman is transmitting this data to the United Kingdom.

World's fastest all-weather jet interceptor is the swift and deadly F-106A. It is equipped with the most advanced electronic navigational and fire control systems and is armed with Falcon guided missiles and the Genie atomic rocket.



Area defense is provided by highly accurate, supersonic Bomarc missiles, which can be launched remotely by the SAGE director. Bomarc can maneuver in the air like a piloted interceptor, but generally at a greater speed and higher altitude.

COMMUNICATIONS-ELECTRONICS FOR STRATEGIC OPERATIONS

A B-58 SUPERSONIC BOMBER, and a B-52 with deadly Hound Dog or Skybolt missiles beneath its wings, spinning condensation trails through the Arctic twilight, presents a picture of awesome power, isolated in space.

Yet an intercom connects their crewmen. Celestial and radar navigation fix their positions. And radio links them with their command posts. For the B-58 and B-52 are metallic creatures with electronic "nerves."

A sleek Atlas rises to blast-off position on a launch pad. It is a slow, deliberate rise, almost ponderous, belying the terrific speed of which it is capable in flight. It received its instruction from electronic computers before its spatial arc to target. For the Atlas, too, is a metallic creature, with electronic nerves.

The Minuteman, soon to confound enemy target analysts by its mobility on specially designed railroad trains, complete with communications center, will be ever ready to streak through the fringes of space aided by electronics. And with the coming of the B-70 Valkyrie, man will routinely speed on his missions at three times the speed of sound.

There is little doubt that the USAF Strategic Air Command, which possesses a major portion of the nuclear striking power of the Free World, is the most powerful fighting force ever assembled.

Yet SAC's ability to react instantly is dependent upon continuous and effective command control of all its aircraft and missiles, regardless of their status or location. And this command control in turn depends upon communications and electronics systems that must be fast, reliable, and global.

Each SAC base has a control room equipped with the most modern communications devices available. These control rooms maintain constant contact with each other and with the Command Post located underground at SAC Headquarters in Nebraska.

The word that launches SAC's weapons is flashed over the primary alert system, the heart of which is the famous red telephone at SAC Headquarters. By simply picking up this phone and speaking the necessary words, SAC's Commander-in-Chief can put his entire force in action. So vital is this primary alert system, that it has a built-in device to check each circuit automatically several times a minute. If any portion of the primary system fails, several alternate systems are immediately available. If the Command Post itself should be destroyed, alternate command posts, complete with communications facilities, are available. One of these is an airborne command post, built into a modified KC-135 refueling jet aircraft.

When BMEWS, DEWLINE, or any other warning system flashes a signal indicating an attack, SAC is geared to get its alert aircraft off the ground and to start the countdown on its ICBM's within 15 minutes. But since the alert may be a false alarm, the bomber force proceeds only to a predetermined line on the strike route. Missilemen stop their countdown and hold—for once a missile is launched it cannot be recalled.

This is the so-called Positive Control System, under which neither bombers nor missiles take the final, irrevocable step unless they receive definite orders to do so. If it is a false alarm the alert is cancelled. The missilemen relax and the bombers return home. The importance of orders to these forces demands that the communications link which conveys them be as nearly perfect as human ingenuity and inventiveness can achieve.

At present, however, near perfect reliability means redundancy in systems—the maintenance of duplicate or alternate fixed and mobile communications networks at peak readiness. This is why SAC, in controlling and directing its force, must use hundreds of thousands of miles of communications channels. This is why SAC employs every modern form of communications and electronics available—telephones, teletype, data systems, television, facsimile, wires, cables, radio, and radar. The Air Research and Development Command (ARDC) is even developing rockets that could be fired hundreds of miles up from hardened sites to provide emergency communications for strategic forces.

For the most part, voice and telegraph message communications are used as the primary means for operating the SAC force. But even these means of communication are rapidly becoming too slow for our needs. The continual increase in the speed of weapons and the consequent compression of warning time mean that we must make increased use of automation. Human beings cannot talk nor compute fast enough, and cannot rapidly assimilate the volume of information needed to make decisions in fighting a bomber-missile nuclear war.

Therefore, ARDC is also developing automatic equipment for SAC, which will lead to true "pushbutton" communications and display. The time it takes to collect information, feed it into a computer and manually post the results on the display panels at SAC Headquarters must be reduced. The new system under development and procurement will provide fully automatic processing of this information from the time it is inserted at the unit or base level until it is presented in the command post—thus greatly reduced handling times will mean more precious seconds for command decisions; for launching the strategic force.

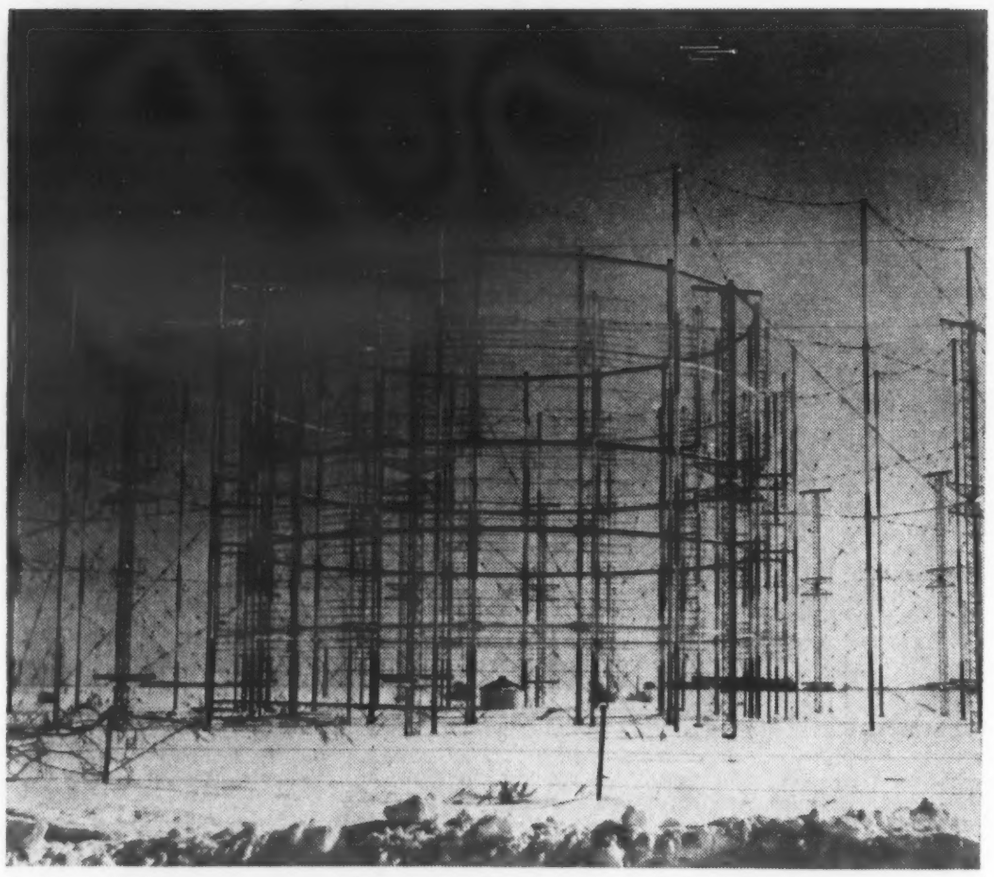
Electronics plays an essential role in the wartime mission of SAC bombers. Ground radar stations are not relied upon for navigation by their crews. Rather, they depend almost completely on the electronic equipment aboard their aircraft. Installed electronic countermeasures equipment acts against enemy radar, enabling the bombers to penetrate defenses. Airborne radar enables them to navigate and to bomb their assigned targets accurately. Inertial navigation devices, electronic recognition equipment, and emergency communications systems help ensure that SAC's mission would be accomplished.

Communications-electronics, then, is vital to SAC's mission. It enables the commander to be continually informed of the status of his force; it conveys instantaneous warning of an attack; it allows reliable command control; and it aids SAC bomber crews in reaching their targets and bombing them accurately. In the nuclear age, it cannot be otherwise.

The Red Telephone—heart of the Strategic Air Command's primary alert system. This telephone has become the symbol of readiness; through it could speed the words that would put SAC's entire alert force into action within minutes.

Here one of the first messages to be sent over SAC's new Short Order System, goes out over the extremely high powered, single sideband network. This system can be used as an alternate means of alerting as well as enabling the SAC commander to direct his airborne force.

Right: Here a technician checks circuitry at SAC's underground telephone central office.



This Wullenweber antenna is used by SAC for single sideband transmissions.

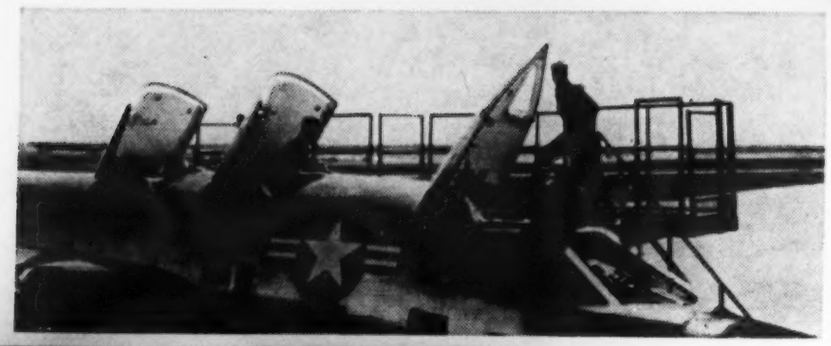
Overview of SAC's underground Command Post, where the entire strategic situation can be ascertained at a glance. Displayed is the data upon which the SAC Commander would base his decisions during strategic, global warfare.

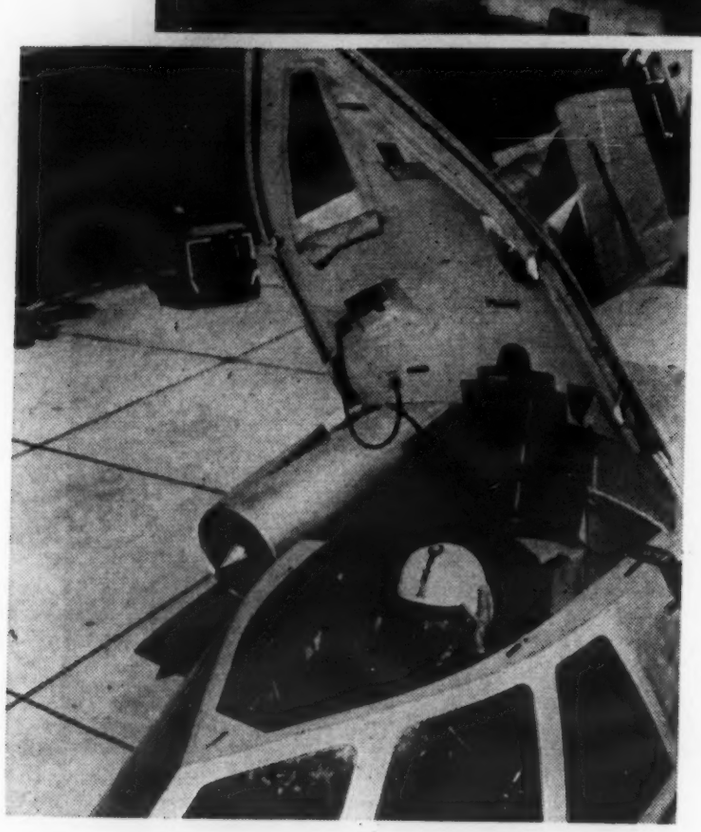
Here again is the famous Red Telephone over which SAC's forces can be set in motion.

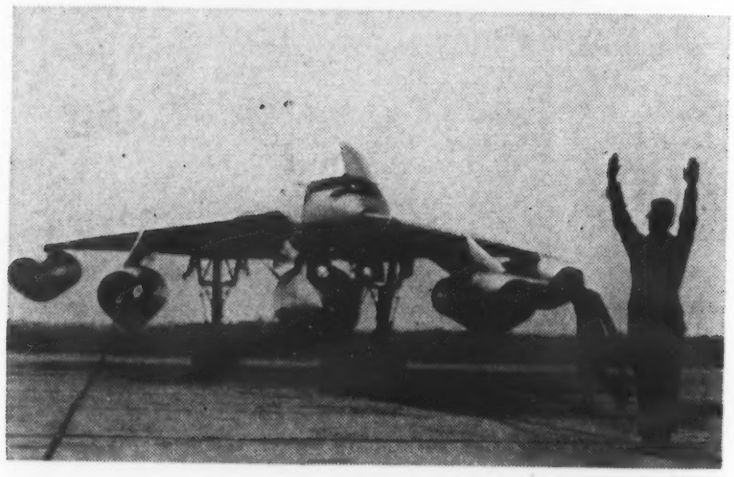
. . . once airborne, the alternate Command Post could assume full control of the SAC Force if the primary Command Post was disabled.

At the word to go, the crew of the Airborne Command Post sprints to get their specially equipped aircraft into the air.

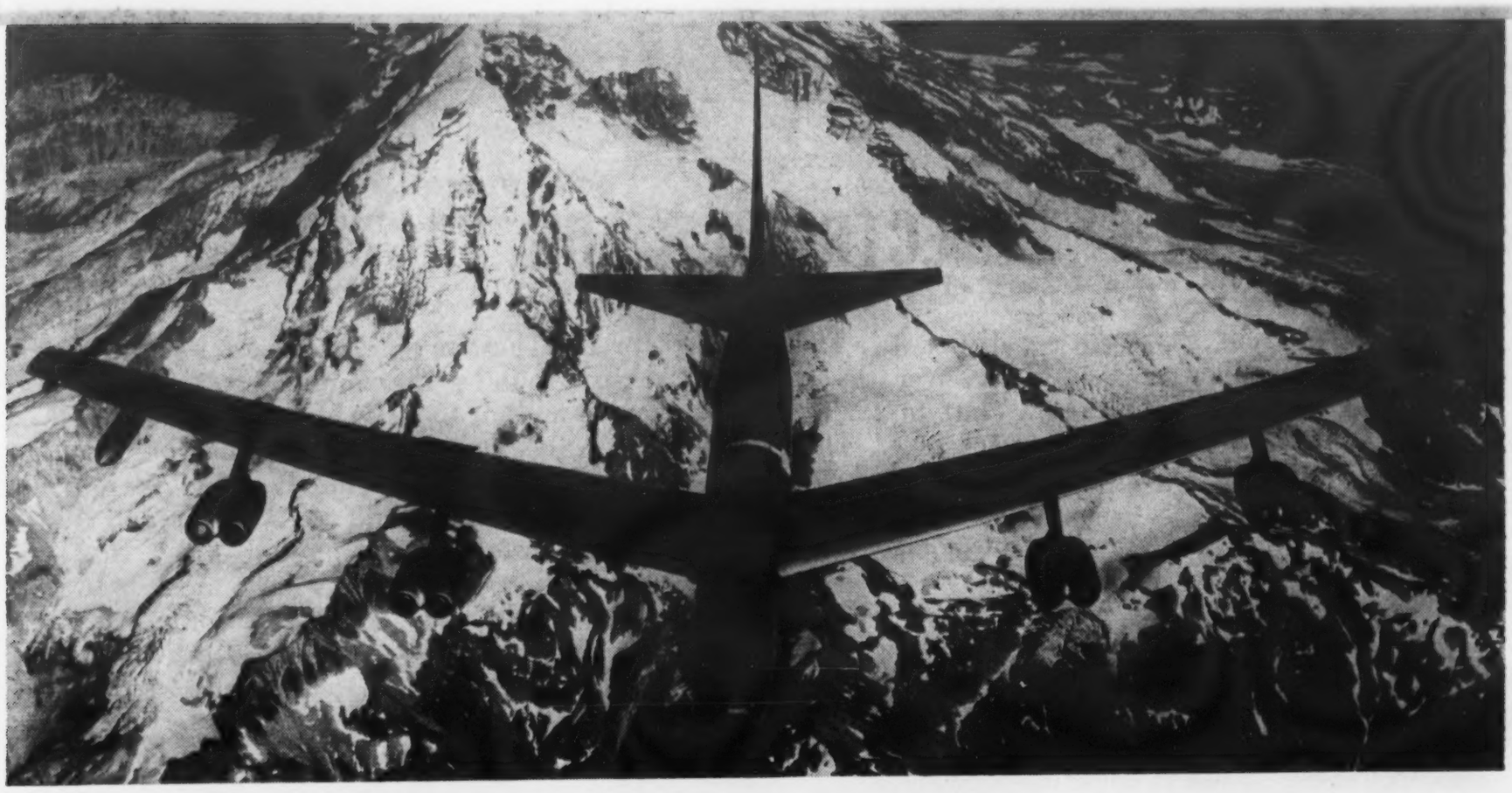
SCRAMBLE.....



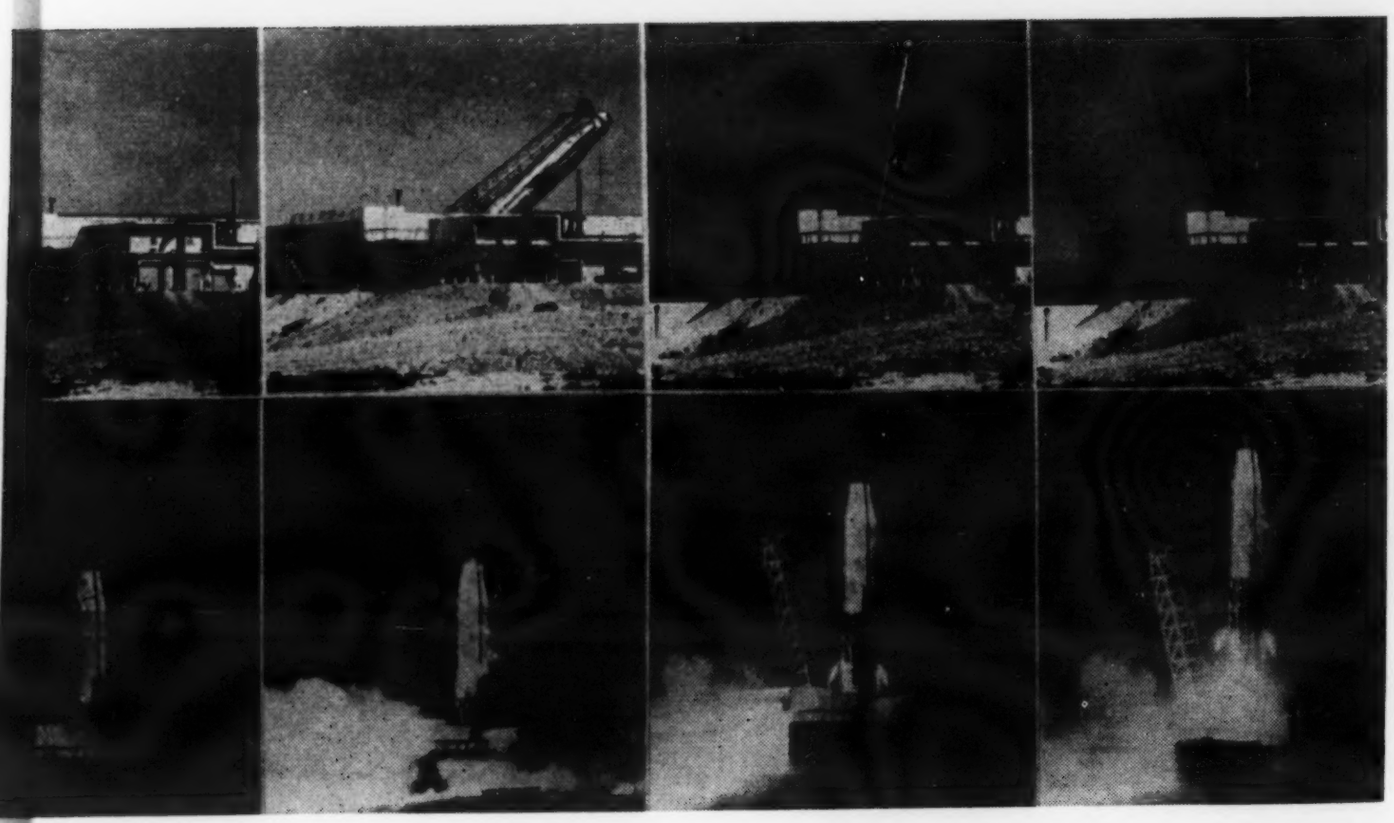




. . . Time Elapsed? MINUTES!

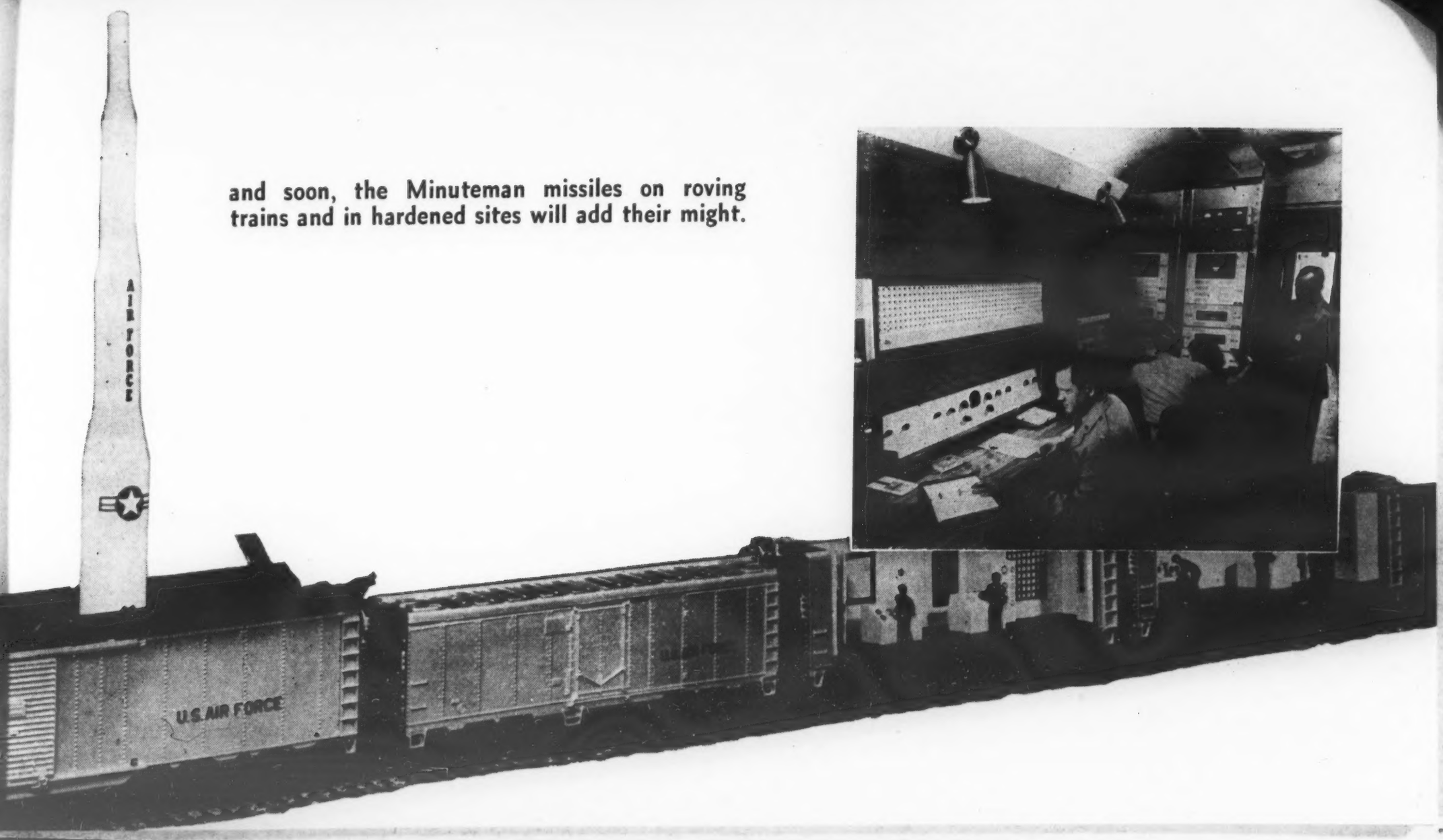


. . . and the B-52's are airborne.



SAC's missileers ready the ICBM's

and soon, the Minuteman missiles on roving trains and in hardened sites will add their might.



COMMUNICATIONS-ELECTRONICS FOR TACTICAL OPERATIONS

TACTICAL FIGHTERS STREAK through the sky. The forward air controller speaks tersely over the radio: "Blue Bird One, this is Flashlight. Your target is dead ahead three miles. Request rocket attack now." The Blue Bird leader radios his acknowledgement, and seconds later a plume of smoke rises from a nearby clearing.

"That's right on target," radios the controller. "Blue Bird Two and Three fire just to the left and right of the smoke."

The two fighters swoop down quickly and the enemy installation disappears in a cloud of flame. At the same time, Matador and Mace Missiles are ready to roar into targets that are suicidal for manned systems. Another successful exercise . . . but it could be the real thing.

Aerospace forces must be prepared not only for global conflict but also for limited wars, such as the conflict fought in Korea. To deter limited wars, or if necessary to fight and win them, the USAF Tactical Air Command has developed Composite Air Strike Forces (CASF). These are essentially complete air forces in minature, capable of global deployment from the continental United States. A CASF can be operational at trouble spots in a matter of hours. They are equipped to deliver nuclear or conventional munitions.

The Air Force also has tactical forces overseas where hundreds of nuclear equipped vehicles—aircraft and missiles—are on strike-alert, keyed to react within minutes. The three functions of tactical air are: (1) achievement of air superiority over the battle area, (2) destruction of targets, equipment and communications between staging areas and the front lines, and (3) close support of ground forces. These functions demand warning and alerting systems, ground-to-air communications, radar ground control units, and air-to-air voice communications.

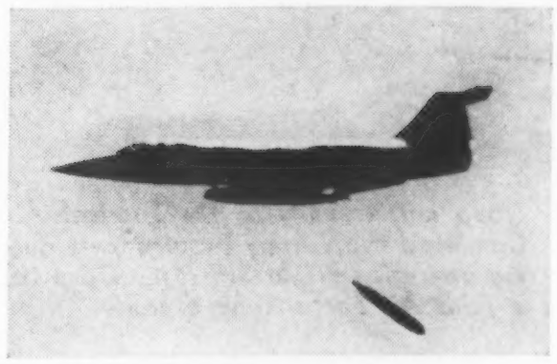
CASF's and tactical forces may be called upon to fight anywhere in the world. For that reason, they must be prepared to move into any area with all equipment essential to sustain their operations, to include internal communications-electronics for forward control.

Not only must communications be provided for the forces in action, but they must provide navigational aids and communications paths into and out of the areas where the fighting is going on. AACS provides these outlets in the form of highly mobile communications units. They, in effect, tie the theater or CASF commander into the Aerospace Communications Complex, giving him most of the services and contacts he would have if he were sitting at his permanent base.

When TAC forces were moved into the Middle East at the time of the Lebanon crisis in the summer of 1958, a mobile communications unit in Europe was on its way to Turkey within hours after it had received the departure order. When the CASF arrived in Turkey, the point-to-point radio, homing beacon, and air traffic control facilities of the mobile unit were already in place and operating.

This communications capability—mobile, capable of sustained field operations, and ready for instant action—is a necessary element in the Nation's deterrent strength. Any aggressor—whether his ambitions are limited or not—must think twice when he knows that the might of the Tactical Air Command is only minutes to a few hours away.

TYPE: F-104C Starfighter—THRUST: 16,000 pound class—DIMENSIONS: Span, 22', length 54', height 13'6"—SPEED: Mach 2 class—CREW: One highly qualified man—PURPOSE: Victory

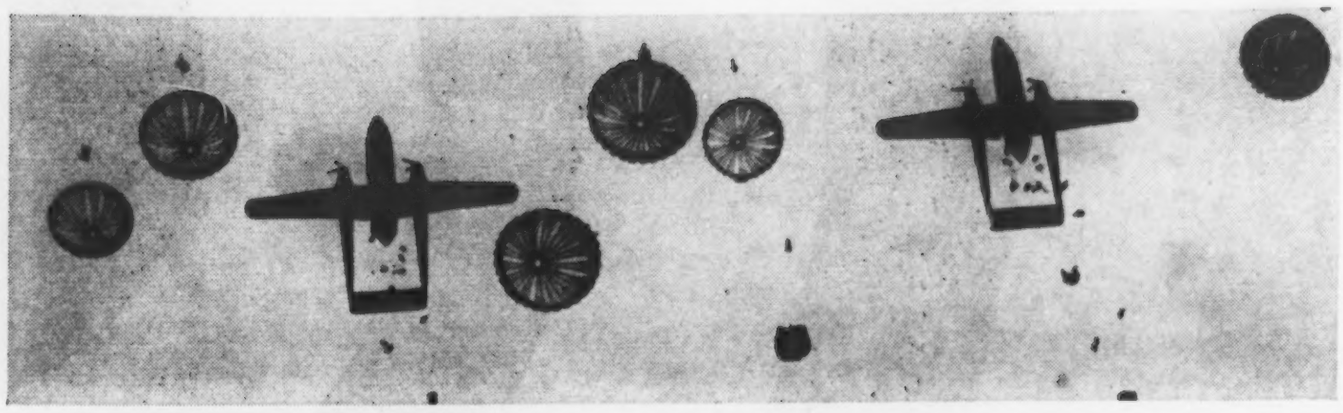


Close support with napalm.

Always alert, airmen and materiel combine for a target strike.

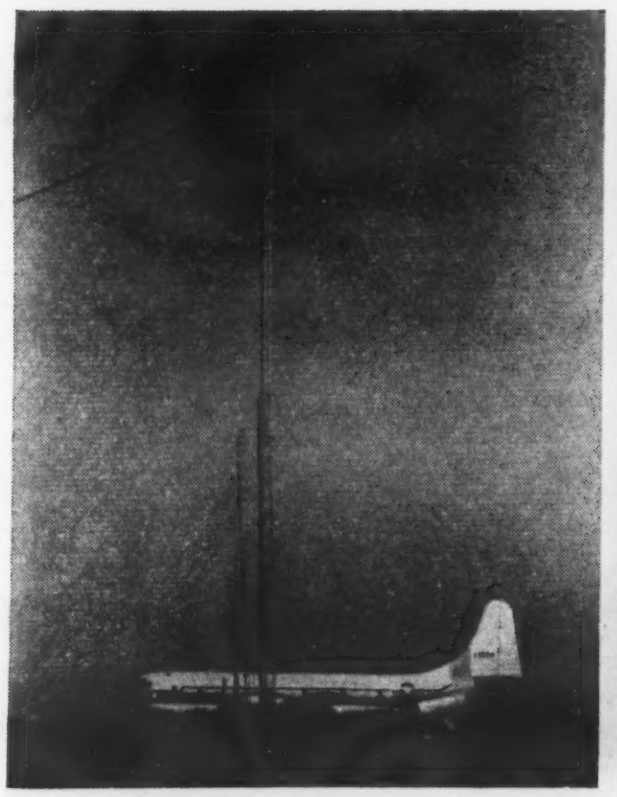
F-105 Thunderchiefs are ready to deploy anywhere on earth.

These TAC pilots, just alerted at Adana AB, Turkey, flew non-stop across the Atlantic and Mediterranean during the Lebanon crisis in 1958.



Troop carrier units of the Tactical Air Command drop Army paratroopers during operation Bright Star/Pine Cone III, a joint Air Force-Army exercise.

Logistics support for Composite Air Strike Forces (CASF) is provided by globe-girdling C-130 Hercules transport aircraft.



(Above left) TAC's "Talking Bird," a Communications and Command Post using the C-97 as a platform, allows a commander to maintain control of his forces throughout all phases of tactical air operations. (Above right) This section of Talking Bird shows the single sideband transceivers and air-to-ground VHF equipment being operated by USAF communications specialists.

USAF Tactical missiles, the Matador (top right and center), and the Mace (bottom) are on duty at overseas locations. The Matador's range is more than 400 miles and it cruises near 600 knots. The Mace has increased speed and range, and an improved guidance system. Tactical missiles complement manned tactical fighters.

THERE IS LITTLE DOUBT that the 1950's were exciting years for the U. S. Air Force as well as for science. As that decade began, even the most daring and far-sighted would have been reluctant to predict that by 1960 the world would hear the voice of the President of the United States coming from a satellite in orbit around the globe; that a space probe vehicle called Pioneer V would send back information on the solar system from a distance of 22.5 million miles.

Now we are in the future with which Air Force and other planners of 1950 were concerned. Now we are facing another future, another decade which could be even more astounding than its immediate predecessor. If present trends continue—and it seems certain they will—accomplishments of the next ten years will far outstrip those of the Fifties. Today, the future usually conveys the thought of space—cislunar space, solar space, galactic space. This is as it should be.

Although the greatest marshalling of men, money, materials and scientific endeavor in American history has gone into the Air Force's development of the four ballistic missile systems—the intercontinental Atlas, Titan and Minuteman and the intermediate range Thor—the Air Force looks forward to satellites and manned systems in space to complement the ICBM's. In its quest to conduct sustained operations at extreme altitudes above the Earth's surface the Air Force has two manned vehicle projects under development. They are the X-15 and the Dyna-Soar, which will place man at speeds and altitudes never before achieved. They are the first USAF attempts to place a man in this medium with the ability to maneuver—a most important capability in the aerospace operations of the future.

To meet the requirements of future aerospace operations, communications-electronics systems are being designed to function in three time periods, the first of which grows more critical day by day, and which in the future will become increasingly acute. This is the *Intelligence and Warning Period*, the era of the existing threat, when volumes of communications traffic must flow at high speed with utmost reliability to maintain the readiness of aerospace forces. The instant the warning is flashed, the second period begins. This is the *Alert and Execute Period*—the time at which the United States is under attack. Information must be passed under the most severe conditions and telecommunications systems must not only be reliable and secure, but *survivable*.

The third period is the *Post Attack Period*. If the systems of the first two periods are adequately built, maintained and operated, the third period problems will be taken care of.

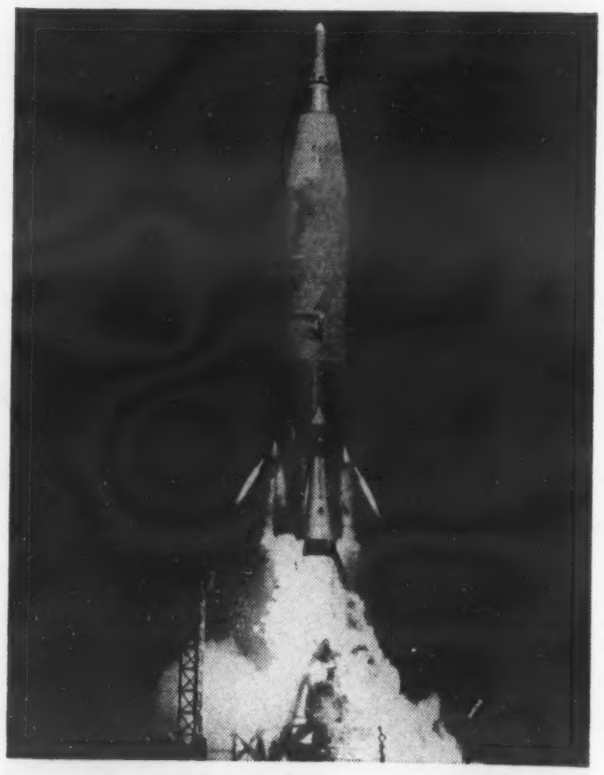
The first period and its requirement for minimum warning is and will continue to be of prime importance. The more warning time you have, the more forces you can launch.

If communications-electronics did not move ahead in pace with the development of new weapon systems, there would soon come a time when our first warning could be the explosion of a nuclear warhead in the United States.

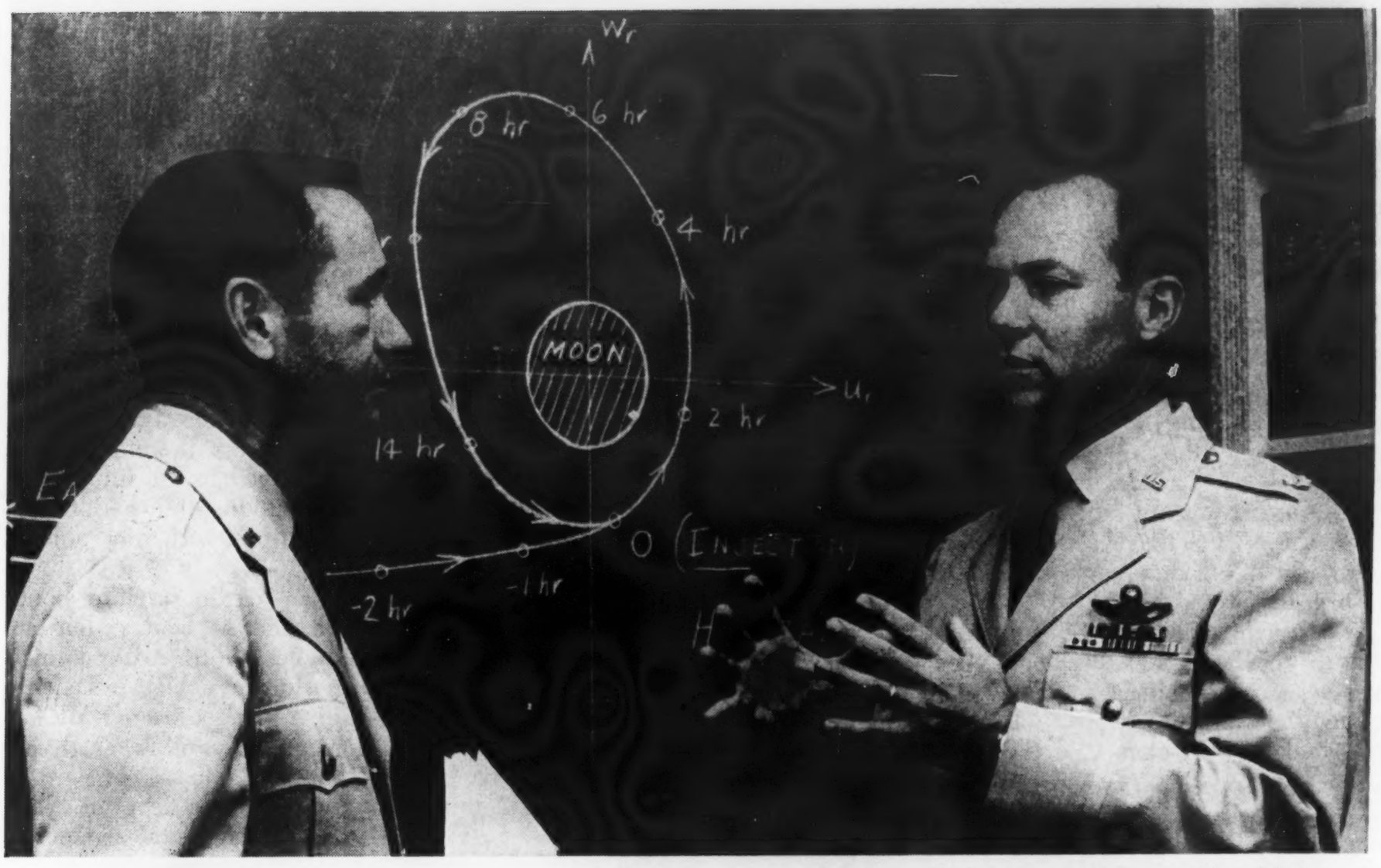
Major programs for the future are designed with this in mind. The early warning system is undergoing extension and modernization to increase areas of coverage through incorporation of new, automatic devices as they are developed. Improved data processing equipment for the SAGE Air Defense System will provide better control of continental air defense against air-breathing targets. When finished, these improvements will be more survivable and will provide the air defense commander with a greater degree of command and control of his forces.

Another significant advancement will be the modernization of one network of the Aerospace Communications Complex—our Combat Logistics Network (COMLOGNET). This modernization includes installation of five completely electronic communications message and circuit switching centers in the United States. The first of these will be put in service this year; the entire network will be operational early in 1962.

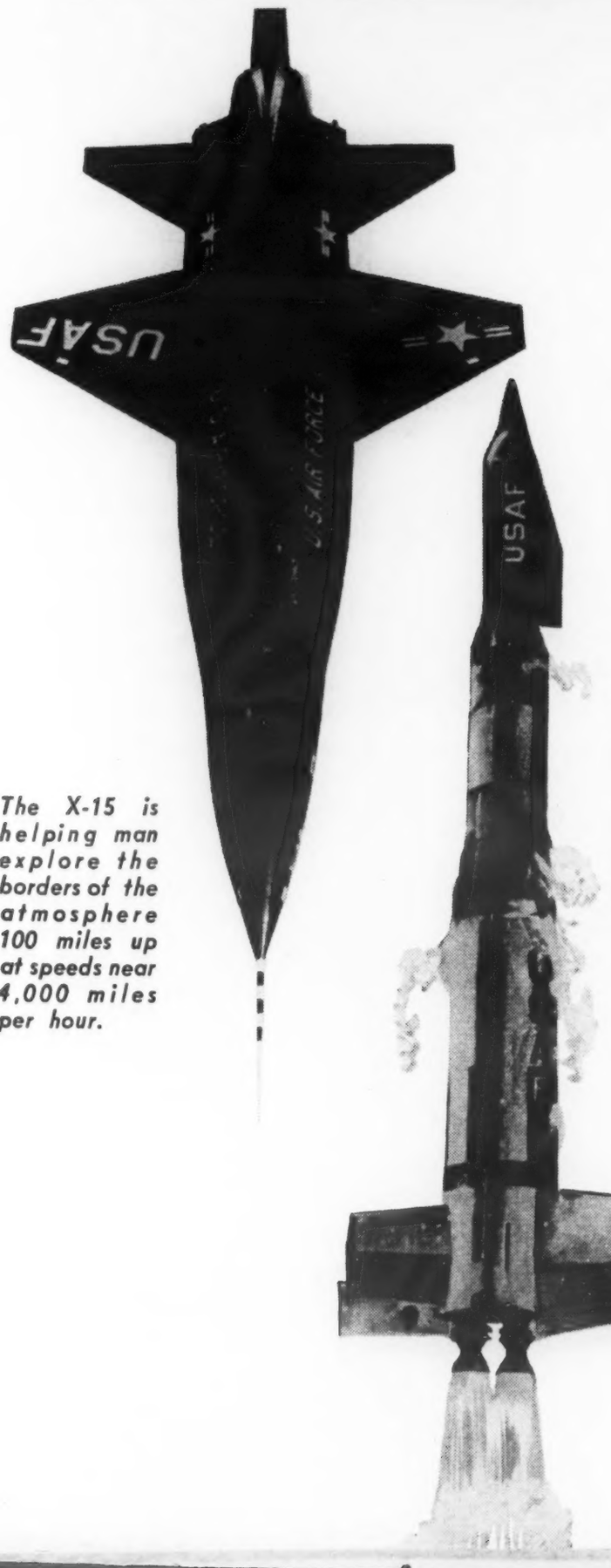
COMLOGNET is designed primarily for logistics data, but it will also be used to convey messages dealing with aircraft movements, air traffic maintenance, passenger information, flight control data, and a variety of personnel statistics.



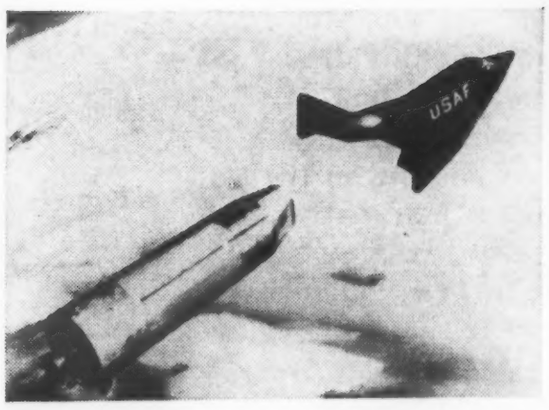
From Cape Canaveral to the Indian Ocean is 9,000 miles. This is the Atlas that made such a journey on May 20, 1960.

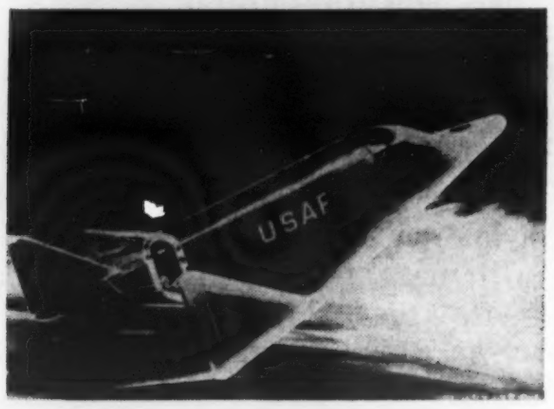


Plotting a moon orbit for a U. S. space vehicle are Maj. Edwin D'Arcy, who has a masters degree in aeronautical engineering from Purdue, and Maj. James Smith, who has a masters degree in digital computation from Harvard. Both men are with the Air Force Ballistic Missile Division of the Air Research and Development Command.



The X-15 is helping man explore the borders of the atmosphere 100 miles up at speeds near 4,000 miles per hour.





Special communications-electronics problems will be posed by space operations of which the Dyna-Soar and X-15 are the forerunners. An artist's rendering of the flight of USAF's Dyna-Soar shows: A specially adapted Titan ICBM boosting the Dyna-Soar glider toward space; the booster dropping away, leaving the glider and pilot, near orbital flight later to glide to a conventional landing at an Air Force Base. In the planning stage are more powerful boosters which will permit orbital flights for the gliders. When the pilot dips the craft into the earth's blanket of air, its leading surfaces glow from friction.

COMLOGNET will link the Air Materiel Command with some 450 air bases, air stations, depots and civilian suppliers, and will be able to handle the equivalent of one hundred million words daily.

The Air Force is also developing two improved intelligence systems. The primary purpose of one is to convert information into data, process it and display it rapidly and completely. The other is a highly technical futuristic system which will integrate information from a number of specialized ground and airborne intelligence gathering stations which work with electromagnetic radiations.

Intelligence information, surveillance data, and detection and warning systems are designed for one purpose: To display the material so that if the alert and execute period ever arrives, commanders can make the proper decisions, exercise intelligent command and control of their forces. As NORAD gets improved display centers, so also will the Commander-in-Chief of SAC. Automatic data processing and display systems will soon provide the SAC commander with a more instant access to the status of his forces and the means to control them; such a system is also being provided for senior AF officers who must know the disposition and availability of all forces and support groups in the Air Force.

Echo, the passive balloon satellite launched by the Air Force last year for the National Aeronautics and Space Administration, will doubtless point the way to future systems. In one of many tests, a signal was reflected via Echo from the West Indies to New York—an earth distance of 2,400 miles.

Forces poised to go in minutes must know the weather conditions throughout the world every minute of every day and night. Tiros, the weather satellite, is essentially a communications device. By acquiring information about the earth's cloud cover, and other weather phenomena, and transmitting it back to meteorologists, Tiros makes possible longer range and better forecasts. That is why, in conjunction with the weather satellite program, there is a development program for an integrated system for transmitting, processing, and displaying weather data for quick use by all operational units.

Navigation satellites, such as the U. S. Navy's Transit, will make feasible navigational aid for both aerospace craft and ships. Echo, NASA's balloon satellite; Score, an active repeater satellite riding on an Atlas; and Courier, an active delayed repeater satellite developed by the Army, have ushered in a potential new era in communications technique.

With all the satellites in orbit now and coming in the future, keeping track of them will be a major task. Shortly after BMEWS went on defense duty in October 1960, the Navy-developed SPASUR (Space Surveillance Detection Net) and the Air Force's Space Track were being integrated into the continental Air Defense system. SPASUR is an east-west satellite detection fence developed to discover, identify and predict orbits for "dark" or non-radiating satellites. It extends across the southern U. S. and reports to Space Track, which catalogs satellite orbital data.

It has been predicted that in the next ten years there will be communications systems capable of spanning interplanetary distances of several hundred million miles. These will be used to transmit complex data, including pictures. For the transmission power problem, new methods of information coding and processing will permit compact, reliable, low-power-drain communication links capable of handling much more complex information than at present.

The growing volume and nature of traffic point to a need for increased transmission rates which means wider and wider bandwidths. The only logical means known today to obtain wider bandwidths is through the use of higher frequencies—because of the existing crowded condition at the lower side of the frequency spectrum. Orbiting communications satellites show promise as one answer for wider bandwidths through line-of-sight operation.

Active and passive earth satellites are seen as a logical means of extending the range and reliability of point-to-point, air-to-air and air-to-ground communications.

Active satellites have the capability of real-time relay or delayed repeater transmission of messages sent to them from ground stations. Doubtless there will be many more types of satellites developed in the future, but they will all have the purpose of giving this nation a system of instantaneous communications with any point on or above the earth's surface.

The imminent Midas, an earth satellite containing infrared sensors which can detect heat radiation from the engine of ballistic missiles shortly after launch, will be able to feed its information into the Air Defense System and double the warning we get from BMEWS.

Midas will be supplemented by other earth orbiting satellites under development. Samos is one—there are others. Reconnaissance satellites can keep an eye on the enemy, detecting activities which could mean preparation for an attack.

This type of intelligence, as well as that from a thousand other more prosaic, earth-bound sources, is useless unless it gets to the right people at the right time. Warning alone is not enough unless you have the ability to respond—to alert and execute, and maintain command control. To insure that you have the means to command during the alert and execute period, you must have and exercise these means during the Intelligence and Warning Period.

Some of the telecommunications facilities are, of course, suitable for use in all of the three time periods. The important point is that no single system is likely to be the solution of all USAF communications problems. The answer, as with weapons, will be found through the continued and highly coordinated use of several methods.

A major Air Force goal is the achievement of manned space flight and the extension of the USAF operational capability into that medium. To reach solutions to such future aerospace problems, Air Force Communications-Electronics planners have set up the following minimum communications-electronics objectives:

1. An increase in data handling capacity by a factor of 10 and at a rate of 4800 bits per second.
2. Full security of voice, teletype, and data circuits.
3. Printed messages at speeds up to 2000 words per minute.
4. 99.99% reliability.
5. Rapid graphic and photographic transmission with speeds up to 24 square inches per minute.
6. Compatibility with other military networks within the framework of the Defense Communications System, and compatibility with commercial communications of the United States and its Allies.

President John F. Kennedy has said, "Control of space will be decided in the next decade. If the Soviets control space, they can control earth."

Thus, United States supremacy in space is essential to our security. As we move into this new environment, communications-electronics will face its greatest challenge—a challenge it has accepted and will meet!

Weapon systems developed under the Air Force Ballistic Missile Division (AFBMD) include the Thor IRBM, and the Atlas, Titan, and Minuteman ICBM's. Satellite programs being executed by AFBMD are Discoverer, Samos, and Midas.

Long range radars and a closely knit communications network enable missile recovery crews to receive the information needed for split-second operations necessary to recover space capsules in flight. Shown below is the air crew which made the first successful air recovery of a re-entry capsule on August 19, 1960. The nose cone of Discoverer XIV was placed in a sealed container prior to removal from the recovery aircraft.

AT THE PRESENT RATE of its technological growth, communications-electronics systems could undoubtedly become capable of detecting an attacking air weapon, identifying it, reporting its presence to an entire continent, selecting the weapon to attack it, launching the weapon, guiding it to the destruction of the target, and simultaneously launching a retaliatory force—all without the necessity of a single person getting into the act. However, a completely automated system of this nature is unlikely ever to be used. The final decisions must always be made by people!

It is people—in the military, in industry, in universities, who discover, design, devise, develop, test, operate and maintain; people think; they reason and they decide!

Sixteen per cent of the Air Force, or 125,000 live human beings, are directly involved in communications and other electronics work. More than 30,000 of them are assigned to the Airways and Air Communications Service (AACS)—which will soon be incorporated into the new 58,000-man Air Force Communications Service.

Because of the incredible advances made by the Air Force in equipment and techniques, the responsibilities of communications personnel have changed. Yet, in spite of a great increase in facilities, the Air Force has been able to hold the number of operators to 12,000; the same number it had in 1951. But the number of maintenance men, which was nearly 17,000 in 1951, has more than trebled, a direct reflection of the increasing use of automatic and semi-automatic facilities.

These changes are also reflected in training. Most Air Force communications and electronics training is given at the 3380th Technical School operated by the Air Training Command at Keesler Air Force Base, Mississippi. The Keesler curricula include both basic and specialized courses in maintenance of radio and radar equipment. Most vary in length from 22 to 51 weeks. In addition, there is a communications-electronics staff officers' course which trains "executives" to manage the over-all C-E "business" of the Air Force.

Every year the school graduates 28,000 officers and airmen, many of whom receive further factory training and all of whom receive on-the-job training in their new assignments. In addition to this training at Keesler, cryptographic training is given at Lackland Air Force Base, Texas, and about 1400 teletype operators are trained each year at Sheppard Air Force Base, Texas.

The latest trend in training is to replace narrow, overspecialized courses with courses giving training in general principles and covering a greater variety of equipment. Six types of training in the Air Control and Warning (AC&W) field, for example, have been combined into one course. Four microwave specialties have been combined into two. Similar consolidations have reduced the number of specialties in the maintenance field from over 70 to fewer than 30, although exactly the same equipment is covered. These course combinations not only improve the quality of the training, but they also permit savings in manpower and allow for more flexible assignments. A man who knows how to repair three or four types of equipment is obviously more versatile and valuable than a man who can repair only one.

Admittedly, many communications-electronics assignments are arduous ones. By their nature, electronic warning facilities and virtually all communications facilities must be operated around the clock. Since many of them are in isolated areas, communications-electronics personnel as a group receive a higher-than-normal share of remote duty assignments. AACS, for instance, estimates that thirty per cent of its personnel overseas are serving in remote areas.

Installation of specially designed equipment, along with better facilities, operating procedures and manning practices, may lead to a reduction of isolated duty tours. Of course, such tours will never be entirely eliminated. Yet, to the adventurous, isolated duty in the high Arctic or other places in the world is more of an opportunity than a disadvantage.

As the Air Force looks at its widespread communications-electronics facilities, so it looks to the high dedication and skilled competence of the people who research, design, manufacture, command, operate and maintain them, both industrially and militarily.

These are the people who make Air Force communications-electronics work. These are the people who are engaged in one of the most rapidly growing, exciting, gratifying and essential careers in the world.

In the Air Force—in Air Force Communications-Electronics—people are our most important asset.

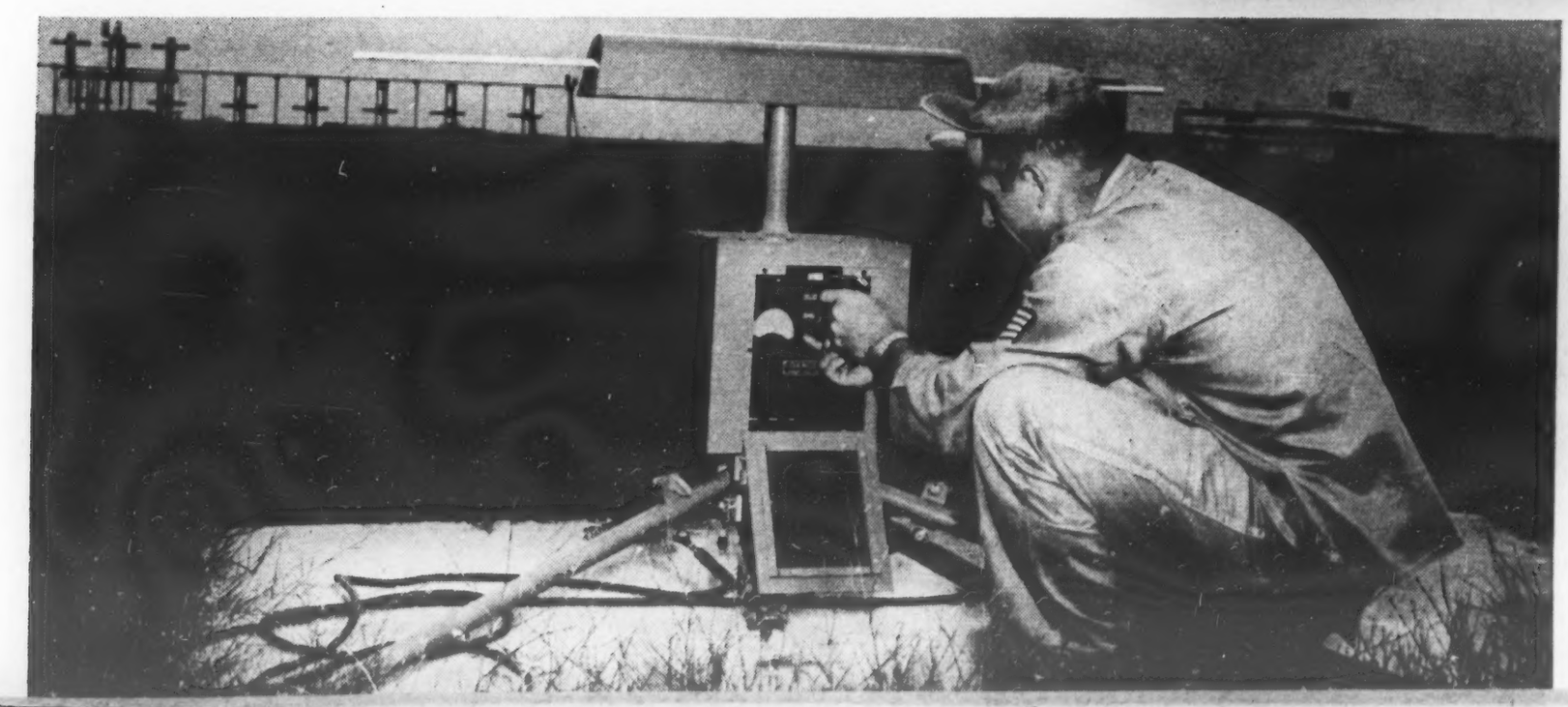
24-HOUR DUTY . . . A winner in the command photo of the month contest, this photograph was taken of an airman operating AACS equipment.

Launching a space vehicle via a direct line between control center and launch site.

Right: Continuous operation requires continuous maintenance by highly skilled Air Force personnel.

Below: In the circuit control room, technicians must remain constantly alert to guard against circuit difficulties, and provide alternate routing when necessary.

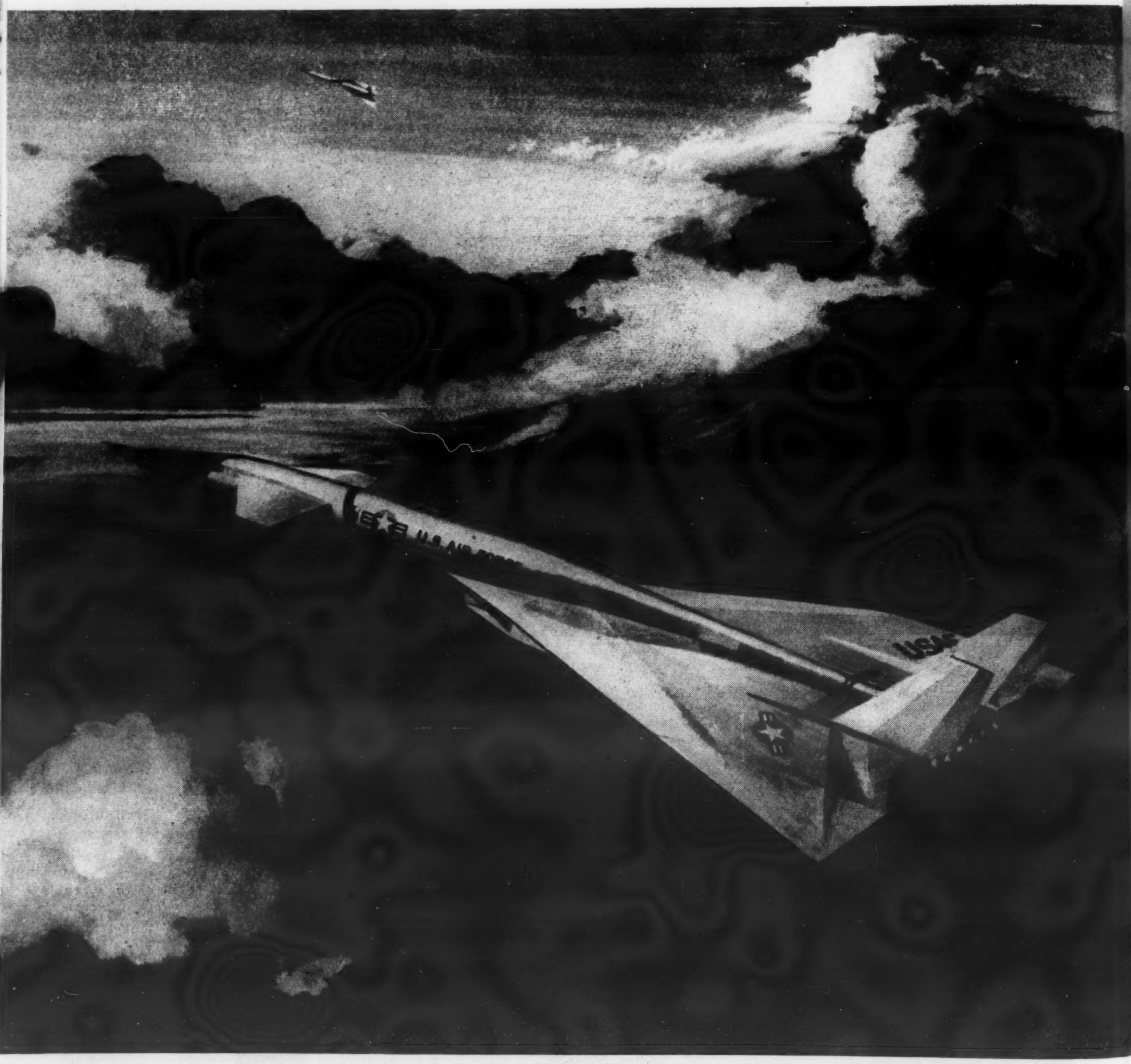
Right: Personnel who continually man vital links in the USAF Aerospace Communications Complex are highly trained, responsible individuals upon whom the successful accomplishment of the Air Force mission is largely dependent.



Lives depend upon how well this professional airman (left) does his work. Here he aligns an Instrument Landing System by which aircraft land in zero-zero weather.

PEACE TIME AEROSPACE OPERATIONS

. . . . . in concert with other nations, the preservation and universal observance of the equitable and peaceful uses of aerospace.



EXTENDED RANGE • MOBILITY • IMMEDIATE REACTION • PENETRATIVE ABILITY • FLEXIBILITY • FIREPOWER DELIVERY • SPEED

New Data Interchange System Tightens Naval Fleet Coordination The new Naval Tactical Data System will permit a task force, dispersed over a 300 mile area, to be operated by its commander with the same flexibility and tactical control he exercises over his flagship. Information from radar, sonar and other sensing sources gathered by all surface and airborne elements of the task force will be continuously displayed, providing intelligence for directing missile-launching functions, reconnaissance operations and tactical maneuvers.

Alpha is providing system engineering and management for the channeling of the intelligence data from each unit's computer and the transmitting by single sideband radio to like computers in each other unit of the force. This computer-to-computer instant sharing of intelligence is the heart of NTDS.

Alpha CORPORATION
A SUBSIDIARY OF COLLINS RADIO COMPANY

SYSTEMS DESIGNERS, ENGINEERS, CONSTRUCTORS, WORLD-WIDE • RICHARDSON, TEXAS • TELEPHONE DALLAS ADams 5-2331

SIGNAL·GRAM

— GOVERNMENT —

NEW AF COMMUNICATIONS COMMAND will be established in July 1961. To be known as Air Force Communications Service (AFCS), the command will assume control on a global basis of all point-to-point, air and ground communication facilities under Air Force jurisdiction. Organization of the separate command will transfer all communications operating responsibilities from other major air commands and will eliminate the now existing Airways and Air Communications Service (AACS). Complete transfer of all facilities is scheduled for completion by July 1963. AFCS headquarters will be at Scott Air Force Base, Ill.

U. S.-AUSTRALIAN CONVERSATION was made possible by bouncing signals off the moon, Feb. 10. Hugh L. Dryden, Deputy Administrator of NASA, talked by telephone from Washington, D. C., to Alan Hulme, Australia's Minister for Supply, in Woomera, Australia. Transmitted by telephone lines to NASA's tracking station at Goldstone, Calif., Dryden's message then was beamed to the moon and transmitted to Australia. Although this was not the first time a voice message has been bounced off the moon, this is believed to be the first time a message was sent over such a great distance. The goodwill message traveled 455,682 miles.

FCC LOCATED THE SANTA MARIA while patroling the radio spectrum and monitoring signals. After hearing a message from the hijacked Portuguese liner on Jan. 24, the Federal Communications Commission monitoring stations fixed the positions of the vessel which enabled the Navy to follow up with sea, air and radio operations. The monitoring and direction-finding methods used in this instance are the same as those used by the FCC in determining the position of disabled ships and aircraft in search and rescue operations.

AF MINUTEMAN MISSILE hit a target 4,000 miles away on its first test flight, Feb. 1, as all three solid-fuel stages functioned perfectly. It was the first time that three untested stages of a U. S. missile were tested in one flight. Minuteman, the Air Force's solid propellant weapon, is scheduled to become operational in 1962.

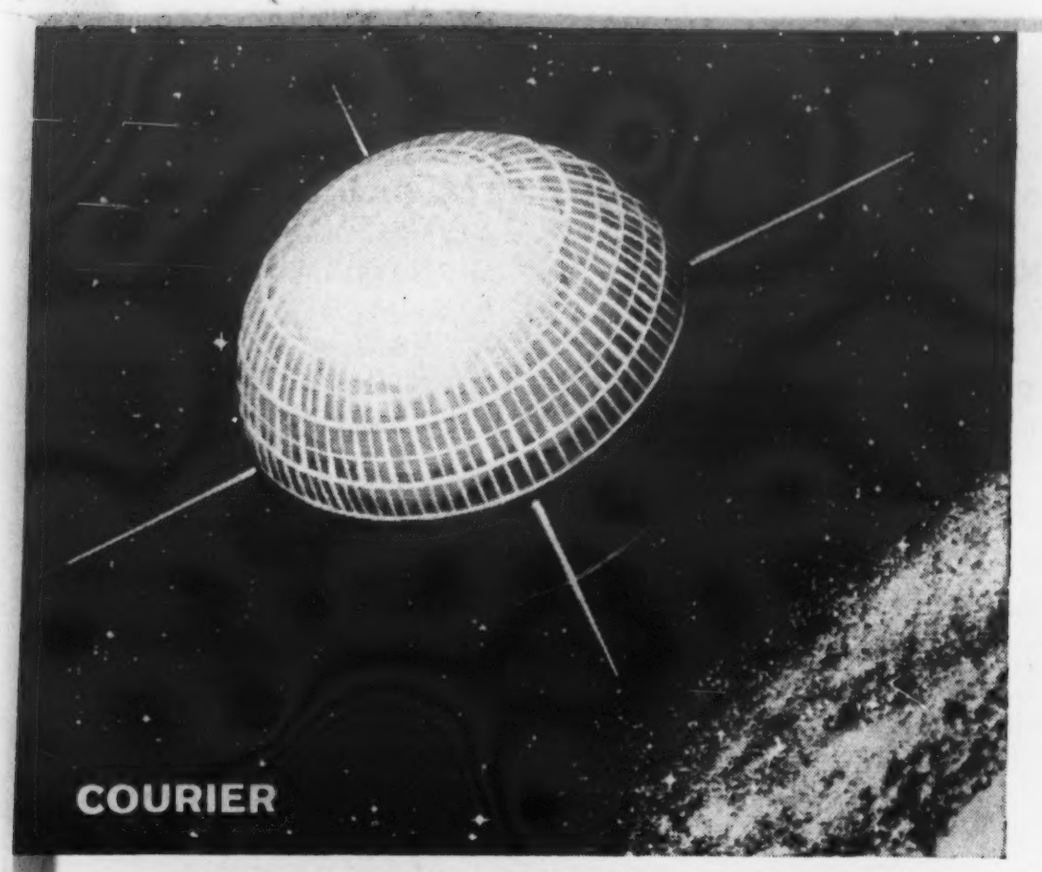
"HAM" CAPSULE was recovered successfully after a journey 155 miles into space aboard a Redstone rocket, Jan. 31. The capsule contained the 37-pound male chimpanzee, Ham, who is undergoing tests which should help determine some of the hazards a man would encounter in space. A similar flight with one of the astronauts in the Mercury capsule may be attempted early this year, NASA hopes.

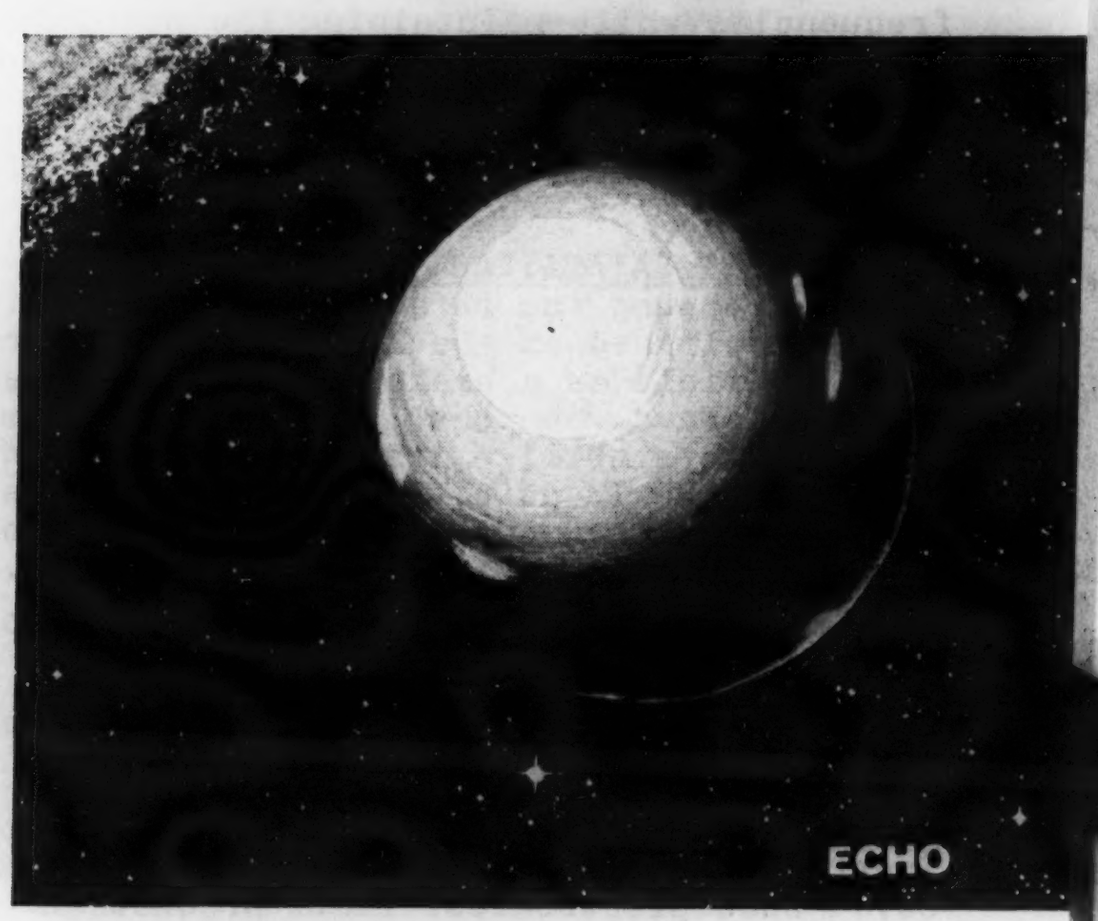
EXPERIMENTAL SAMOS SATELLITE was put into orbit Jan. 31. Samos is an early design of a vehicle eventually intended to provide the United States with a fleet of satellites equipped with cameras for providing constant surveillance on every point of the earth. The program is under Air Force direction.

LESS SATELLITE INFORMATION will be available in the future, as the result of a Pentagon move aimed at concealing from an enemy details of U. S. military space vehicles. The National Space Surveillance Control Center at Hanscom Field, Mass., has been directed to stop distributing situation reports on satellites in orbit, lunar and space probes and delayed satellites. This Air Force center, which maintains surveillance of all man-made satellites and other objects in space, has been advised to refer all inquiries for space data to the National Aeronautics and Space Administration which will make future announcements about space achievements.

VOA MOBILE RADIO STATION for use in "emergency" operations could be constructed in a year's time if Congress approves a request for $1,859,000 contained in the Eisenhower budget. Transportable by air or surface ship, the Voice of America relay station could be ready for operation at a distant land base in 30 days. In addition to the construction cost, funds to operate the station would amount to about $300,000 a year, if the station were used on a continuous basis. The station would be manned by 18 VOA employees.

(*Continued on page* 46)





Philco Achievements in Space Technology

Philco has made many major contributions to the nation's vital space programs. COURIER, the world's first advanced communications satellite, was designed and built by Philco. Philco played a major role in the development and installation of the complex communications, command, tracking and data systems for the DISCOVERER program. Space-borne and ground communications systems for MIDAS and other satellites have been Philco designed. Philco developed and installed the tracking and receiving systems for the Air Force Passive Satellite Relay Link, which utilizes the ECHO satellite. In the field of human factors engineering, Philco has developed personnel subsystems for several major space projects. Philco also produces the world's largest 3-axis satellite tracking antennas.

These achievements are dramatic evidence of Philco's ability to integrate its extensive resources to the design and production of the most sophisticated electronic systems. For capacity, facilities and experience in space technology, look to the leader . . . look to Philco.

Government and Industrial Group, Philadelphia 44, Pennsylvania

PHILCO®

Famous for Quality the World Over

Communications and Weapons Division • Communications Systems Division
Computer Division • Sierra Electronic Division • Western Development Laboratories

TWO KENNEDY SELECTIONS of note are James M. Gavin as United States Ambassador to France and James E. Webb as Administrator of the National Aeronautics and Space Administration. A 53-year-old retired Army lieutenant general, he was president of Arthur D. Little, Inc., Cambridge, Mass. before his present appointment. At the time of his retirement from the Army in 1958, General Gavin was Deputy Chief of Staff for Research and Development. The new NASA chief has served as a director of McDonnell Aircraft Corp. and as a vice president of Sperry Gyroscope Corp. Mr. Webb has held the government posts of Budget Bureau Director and Under Secretary of State.

WHITE HOUSE STAFF APPOINTMENTS of particular interest include Jerome B. Wiesner, special assistant for science and technology; Brigadier General Chester V. Clifton, military aide; Colonel Godfrey T. McHugh, Air Force aide; Commander Tazewell T. Shepard, naval aide.

NAVY SATELLITE COMMUNICATIONS SHIP will be used in the Army's Project Advent, a system of providing world-wide instantaneous radio communications by using high altitude satellites placed in a 24-hour orbit. The Navy's Bureau of Ships will design and develop equipment for a shipboard satellite communications terminal capable of communicating with two Army shore stations through the Advent satellite. The ship will contain an antenna system capable of both transmitting and receiving at microwave frequencies while maintaining the pointing accuracy required in spite of the ship's motion. Other equipment will include radio receivers and transmitters, communications security devices, trackers and telemetry equipment, an ultra precise timing system, accurate navigation equipment, and complex computation and display equipment. A World War II Victory Ship hull will be modified for the Advent shipboard terminal.

TWO TRANSIT SATELLITES "DE-SPINNED"—that is Navy scientists have succeeded in virtually stopping the rotation of the orbiting navigation satellites. The achievement was accomplished on the Transit I-B and Transit II-A vehicles by using the earth's magnetic field as a brake, according to Rear Admiral Paul D. Stroop, Chief of the Bureau of Naval Weapons. A satellite is made to spin when it is launched into orbit in order to stabilize its motion. Ultra high stability radio transmission requirements for the Transit, however, made it necessary to reduce the satellite's spin rate to less than one revolution in 100 seconds. These requirements were met by despin rods in each of the Transit vehicles. Thus frequency noise was reduced.

ARMY RESEARCH OFFICE at Durham, N. C., has been transferred to the command of the Army Chief of Research and Development as part of the plan to strengthen Army R&D mission assignments. Formerly known as the Office of Ordnance Research, Army Research Office–Durham will monitor and support the basic research program of all the technical services of the Army in the physical sciences field.

CONTRACTS: ARMY: Bendix Corp., Eclipse-Pioneer Div., continued manufacture of inertial guidance system for Pershing missile, $20 million (subcontract from Martin Co.); Budd Electronics, Inc., production of radio relay equipment, $2.4 million; Telecomputing Corp., Telecomputing Services, Inc., to provide data reduction for daily missile firings at White Sands Missile Range, N. Mex., $2 million. NAVY: Westinghouse Electric Corp., additional production of radar portion of air missile control system for F4H-1 Phantom II fighter plane, $8.3 million; Lockheed Aircraft Co., installation of Julie-Jezebel detection equipment on Neptune antisubmarine aircraft, $4.9 million; Remington Rand Univac, production of peripheral equipment for Naval Tactical Data System and for continuing work on programming and system planning phases of program, $3.5 million; Chance Vought Corp., production of KD2U-1 supersonic drones to be used as targets for Bomarc missiles, $3.2 million. AIR FORCE: Aerojet-General Corp., additional research and development work on MIDAS (Missile Defense Alarm System) infrared subsystem, $12 million (subcontract from Lockheed Aircraft Corp.); Burroughs Corp., installation and logistic support of data processing equipment for SAGE (Semi-Automatic Ground Environment) program of North American air defense, $3.5 million; Pacific Semiconductors, Inc., delivery of ultra high reliability silicon computer diodes to be used in Minuteman ICBM production, $2.1 million (subcontract from North American Aviation, Inc.).

— INDUSTRY —

CHRISTY CORP. will construct two oceanographic research ships for the Navy under a $4 million contract. The vessels will be designed to serve as floating laboratories for use in oceanographic research which will have application to current antisubmarine warfare programs. The ships will have scientific equipment installed aboard to study the ocean and its effect on sound transmission and to make other tests.

COMMUNICATIONS CENTER for development of advanced data transmission technologies for space and military computer information systems was established last month by the Federal Systems Division of IBM Corp. Research work at the Rockville, Md. center will emphasize improvements in systems design and reliability in both radio spectrum and direct wire communications.

(*Continued on page* 48)

SANTA ANNA'S LACK OF RECONNAISSANCE..... MIDWIFE TO THE BIRTH OF TEXAS

Sam Houston said that knowing what the other fellow was doing placed him ahead in the game of war. Santa Anna frequently ignored reconnaissance.

These contrasting philosophies set the stage for a most remarkable battle. On a warm April afternoon, 1836, Santa Anna was enjoying a siesta. His aides sipped champagne nearby. Santa Anna's entire Mexican army felt secure as it nestled against the San Jacinto River.

Presumably, Santa Anna would have been more apprehensive if he had known that a courier, Captain Miguel Bachiller, had been captured by Deaf Smith, one of General Houston's highly effective "eyes." Also captured was correspondence which mentioned that Santa Anna was camped with only a 1,000 man vanguard. Sam Houston's 800 man army paused as Deaf Smith reconnoitered, returning with incredible news . . . not one Mexican scouted between the two forces. The Texans attacked . . . frontally over flatlands in the middle of the afternoon . . . and the result was surprise and victory.

Santa Anna's power had been based on maintenance of a potent fighting force. But Santa Anna's downfall resulted from failure to plan for reconnaissance. He invited defeat by ignoring reconnaissance . . . the military basic that has helped shape the history of the world.

Today, CAI's specialty in reconnaissance is helping shape history to the advantage of the Free World. Typical of CAI contributions is the Integrated Reconnaisaance Intelligence System. Known as IRIS, the system features rapid processing and the ability to produce super-clear photos at any speed, any altitude, day or night. The IRIS system is in production and available now.

For a detailed look at CAI's Full Circle Capability write for the informative brochure, Sight for Flight.

CHICAGO AERIAL INDUSTRIES, INC.

550 WEST NORTHWEST HIGHWAY, BARRINGTON, ILLINOIS • offices: DAYTON, LOS ANGELES, WASHINGTON, D.C.

OTHER DIVISIONS: KINTRONIC, CHICAGO AERIAL SURVEY, Franklin Park, Illinois; PACIFIC OPTICAL CORP., Inglewood, Calif.

SATURN RECOVERY SYSTEM is being investigated by Ryan Aeronautical Co. of San Diego Calif., under a study and design contract from the National Aeronautics and Space Administration. The company will study problems involved in using a flexible wing glide recovery system for the first stage of the Saturn research space vehicle. The Ryan flexible wing, attached to the Saturn booster in streamlined packaging, would deploy at burnout and carry the rocket back to a pre-selected site on land through remote command guidance. The Saturn recovery project is aimed at saving for repeated re-use the expensive 100,000 pound booster which otherwise would burn out and fall into the sea. The Saturn rocket booster, with thrust of 1.5 million pounds, will be flight tested sometime this year.

PACKARD BELL ELECTRONICS CORP. will develop, produce and install an automatic checkout system for the Saturn space vehicle booster, under a $3 million contract from the George C. Marshall Space Flight Center of the National Aeronautics and Space Administration. Replacing manual checkout equipment, the new system to be installed at the Marshall Center's Quality Division will be used for making mechanical and electrical tests on single components, subsystems and completed boosters.

LUNAR SPACECRAFT PLANS are being discussed by officials of the National Aeronautics and Space Administration and Hughes Aircraft Co., the firm selected by NASA for contract negotiations to build a spacecraft called Surveyor. The vehicle will be designed to land gently on the moon, perform chemical analysis of the lunar surface and subsurface and relay back to earth television pictures of lunar features. Plans call for seven Surveyors to be launched to the moon in the period of 1963-66. The California Institute of Technology's Jet Propulsion Laboratory, NASA's center for lunar and planetary exploration, will provide technical direction for the program. Surveyor program is expected to cost more than $50 million.

ANTENNA POSITION PROGRAMMER SYSTEM is being designed and built by Datex Corp. under a contract from Collins Radio Co. The system is expected to be used in tracking NASA Nimbus series meteorological satellites. These research satellites are successors to the Tiros series and the first 700-pound Nimbus is expected to be put into orbit by a Thor-Agena rocket sometime next year. The Datex equipment will supply error signals (antenna steering signals) to the antenna servo system. These signals will be obtained from pre-computed orbit on teletypewriter tape, actual antenna position from an antenna position encoding system, and real time from a digital clock system.

MICROWAVE SUBSYSTEMS will provide the primary communications link in the new $15.5 million MISTRAM missile-tracking system being developed by General Electric Co. for the Air Force. Three separate GE subsystems, tied together at a central station, will provide communications over a total of 90 path miles, connecting precision measurement equipment at outlying points and a central computer. Each of two paths between the outlying areas and the central station carries 18 two-way voice channels used for both voice communication and data transmission. Via a third path, the central station is able to communicate with Patrick Air Force Base and Cape Canaveral over 24 voice channels carrying voice, data, timing signals and range safety data. MISTRAM is the system, scheduled for operational use by 1962, which will check with extreme accuracy the guidance performance of missiles launched at the Atlantic Missile Range.

HOFFMAN ELECTRONICS CORP. has received a $150,000 Navy contract to modify the AN/UPA-24 IFF aircraft identification system. The work, which will be performed by Hoffman's Military Products Div., is designed to remove ambiguity of received signals by improving decoding circuitry. IFF (Identification, Friend or Foe) is used aboard Navy vessels to electronically interrogate and identify aircraft detected by shipboard search radar. A similar system is used commercially in air traffic control by the Federal Aviation Agency.

LING-TEMCO ELECTRONICS, INC., Dallas, Texas, has received a $414,389 contract from the U.S. Army Corps of Engineers to provide a fast response progress reporting system for Titan I missile bases. The company will collect data at each Titan I construction site, rapidly process the data with its IBM 704 electronic computer and related equipment and report the current status of each detail of the construction program to the Corps of Engineers Ballistic Missile Construction Office in Los Angeles and to the affected missile sites.

AIRTRAC SYSTEM, a helicopter-transportable electronic air defense control system, has been delivered to the Marine Corps. Developed by Hughes Aircraft Co., the system will coordinate split-second firing of Hawk and Terrier guided missile batteries at hostile supersonic aircraft. The equipment is installed and transported in helihuts, portable plastic and aluminum shelters which are carried underneath a helicopter.

(*Continued on page* 50)

COMPUTENCE

total competence in computation and data processing—the breadth, the brains and the background

What it means: total competence in computation as it applies to the contract team program and airborne, space, surface, and underwater systems. **What it stands for:** total capability in all areas from basic research through field service, backed by 75 years devoted to computation and data processing. **What it's been doing:** directing the ALRI team and developing its miniaturized airborne data processors; developing and producing Atlas guidance computers and high-speed computers for Polaris; developing high-speed computers for Mauler, U. S. Army's newest automatic firing air defense system. **Where it's going:** to the undefined, the unexplored, the unknown . . . serving the common good and the common goal.

Burroughs—TM

Burroughs Corporation

"NEW DIMENSIONS / in computation for military systems"

CROWN PHOTO, INC., a Washington, D.C. photo processing firm, has acquired four West Coast companies within the past three months. The companies are Chroma, Inc. of Seattle; Keith Cole Studios of San Francisco; Bremson Photo Industries of Kansas City; and Bear Photo of San Francisco.

ITT'S BRITISH AFFILIATE, Standard Telephones and Cables Ltd., London, has received orders totaling more than $25 million for cable and equipment for COMPAC, a new trans-Pacific telephone cable due for completion in 1964. STC will supply 2,800 nautical miles of submarine cable, 242 submerged telephone repeaters and 38 submerged equalizers for the COMPAC project, which is under the general control of the Pacific Cable Management Committee composed of representatives of Australia, Canada, New Zealand and the United Kingdom. The new Pacific cable system will have a bandwidth equivalent to 60 two-way speech circuits spaced 4 kc apart or their equivalent using other types of frequency multiplex equipment.

SSB TRANSCEIVER featuring digital tuning has been developed by General Dynamics/Electronics, Division of General Dynamics Corp. Digital tuning consists of the selection of each digit corresponding to tens, units, tenths, hundredths, and thousandths of megacycles.

SPERRY GYROSCOPE CO. will develop and construct high power transmitters for the discrimination radar system of the Nike Zeus anti-missile missile system. Sperry will do the work under a $11.5 million contract from Bell Telephone Laboratories, prime contractor for the Army project. The Nike Zeus system employs advanced radars and electronic computers to detect and track incoming warheads, discriminate between real warheads and decoy devices and launch and control Nike Zeus missiles to intercept attacking warheads without causing damage to defended areas.

— GENERAL —

RADIO AMATEURS will gather for the Tenth Annual SSB Dinner and Hamfest held during the week of the IRE International Convention. Sponsored by the Single Sideband Amateur Radio Association, the event will take place March 21st at the Hotel Statler-Hilton in New York City.

LEADMASTER COMPUTER SYSTEM of conveying specific attendee interests, and names, back to each participating exhibitor at trade conventions will be used for the first time at the IRE International Convention this month. This digital computer system will save both exhibitors and visitors much time. Instead of spending time filling out cards from an exhibitor, for further information a visitor merely will circle the exhibitor's leadmaster number on his registration card, which is turned in at the end of the convention. Within twenty-one days after the IRE Show, exhibitors will receive the names, addresses and other pertinent information on these visitors. Developed by Data Patterns Inc. of New York City, this system is based upon the use of 1000 numbers which have been assigned to exhibitors and are listed on the back of all the registration cards. AFCEA and SIGNAL, which have booth 4226, will use the leadmaster system.

FREQUENCY ALLOCATIONS FOR SPACE COMMUNICATIONS are being studied by a special group of the Joint Technical Advisory Committee. Sponsored by the Institute of Radio Engineers and the Electronic Industries Association, JTAC advises the Federal Communications Commission on problems regarding the administration of the radio spectrum. This special group, headed by James D. O'Connell, Vice President, General Telephone & Electronics Laboratories, Inc., will make recommendations to the JTAC and will try to get industry members to contribute their ideas and time to solving the complex technical problems involved in Docket 13522.

TWO RUSSIAN SPACE FEATS occurred last month. A 1415-pound spaceship headed for the planet Venus was fired from an orbiting sputnik, Feb. 12. Ten days earlier, the Soviet Union launched a seven-ton satellite.

CALENDAR OF EVENTS:

MARCH 14-17: National Missile/Space Conference, sponsored by National Rocket Club, Sheraton-Park Hotel, Washington, D. C.
MARCH 15-17: Electronic Industries Association Spring Conference. Statler-Hilton Hotel, Washington, D. C.
MARCH 19-25: ASP-ACSM Convention, sponsored by American Society of Photogrammetry and American Congress on Surveying and Mapping, Shoreham Hotel, Washington, D. C.
MARCH 20-23: IRE International Convention, sponsored by all professional groups of Institute of Radio Engineers, Coliseum and Waldorf Astoria Hotel, New York City.
MARCH 21-23: American Meteorological Society General Meeting, Chicago, Illinois.
APRIL 4-6: Symposium on Electromagnetics and Fluid Dynamics of Gaseous Plasma, sponsored by Microwave Research Institute of Polytechnic Institute of Brooklyn, Institute of Radio Engineers, Institute of Aeronautical Sciences and government research groups, Engineering Societies Building, New York City.

PANELS

(1) Federal Bar Association Panel on Government Contract Law and Procedure (Participants include the Assistant General Counsels of the Army, Navy and Air Force.)

(2) Scientific Applications of Photography as Related to Communications and Electronics.

(3) Present Status and Future Concepts of World-Wide Communications to be presented by International Telephone & Telegraph Corporation.

(4) Industry Report on Communications and Electronics Developments to be presented by General Telephone & Electronics Corporation.

SPEAKERS Our feature speaker for the banquet this year will be Mr. Frederick R. Kappel, President of AT&T. A prominent military leader will speak at the Keynote Luncheon and an outstanding industrialist will speak at the Industrial Luncheon.

EXHIBITS Two adjoining hotels will contain quality exhibits from companies which are leaders in the communications-electronics fields plus special exhibits by the Army, Navy and Air Force.

SOCIAL EVENTS Keynote Luncheon—Sparkling entertainment at the Buffet featuring fabulous acts—The magnificent Banquet of Banquets—Industrial Luncheon. Be sure to invite your guests and reserve your tables early.

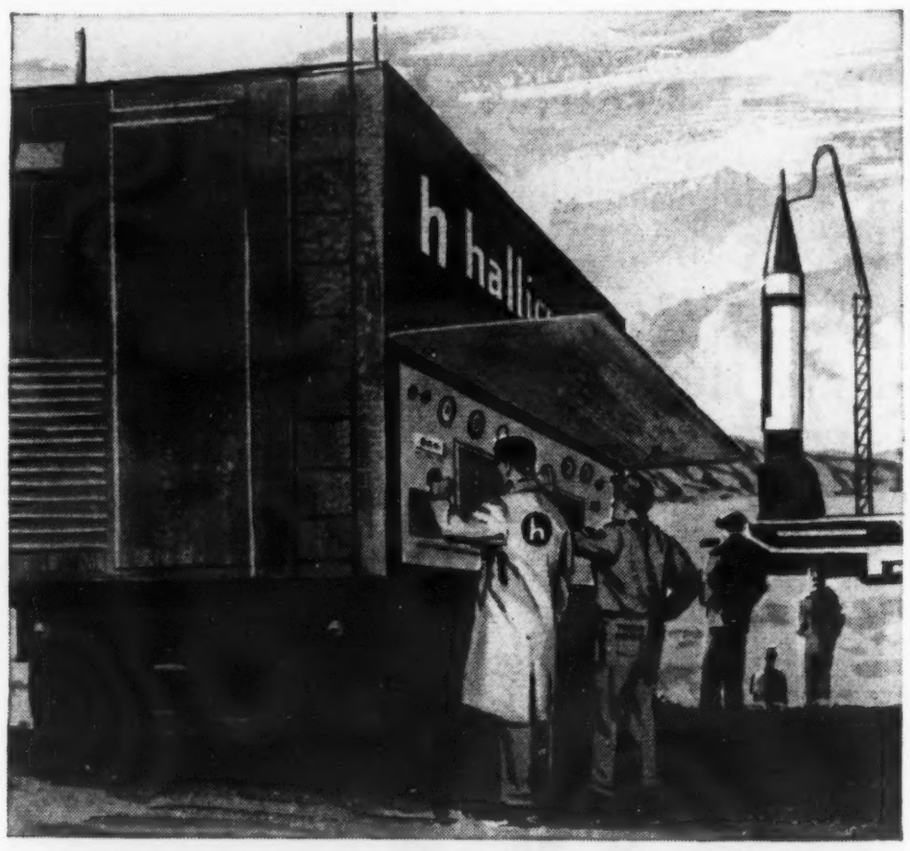
NEW HORIZONS WITH TIME AND DISTANCE IN FULL RETREAT

JUNE SIX SEVEN EIGHT

15th AFCEA Convention • Washington, D. C.
Sheraton-Park and Shoreham Hotels

Every breakthrough in military electronic equipment design creates new, complex and urgent problems in installation, modification, testing, maintenance and personnel training. Hallicrafters radical new "Blue Streak" project—utilizing quick-reaction techniques—*offers experienced Hallicrafters support teams to assist key military personnel . . .* pinpoints problems in advance . . . solves them on the spot with new levels of speed and economy.

from Hallicrafters' "quick-reaction" experience...



TEAMWORK IN MAINTENANCE: Hallicrafters mobile test vans and in-house repair of black boxes sets new standards in speed and reliability.

Looking for a challenging new opportunity?
For this expanding program, we have openings for qualified aeronautical electronic equipment systems and installation engineers. For full details in confidence, contact William F. Frankart, Director of Engineering.

...a hard-hitting

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PErshing 7-2456

Merle J. Long
513 E. Manchester Blvd., Suite 201, Inglewood 1, Calif.
ORchard 2-6861

H. Kenneth Hudson
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CLearbrook 6-4978

Leopold Sternlicht
2 Kolton Dr., Rome, N.Y.
FF 7-7430

James R. Spencer
Box 435, Lincroft, N.J.
SHadyside 7-2369 (Red Bank, N.J.)

Earl L. Giffin
Box 568, Far Hills Br., Dayton 9, O.
AXminster 8-5239

TEAMWORK IN PLANNING: Hallicrafters "BLUE STREAK" Teams provide electronic industry technology in support of military programming groups for SAC aircraft at OCAMA and other materiel commands.

TEAMWORK IN MODIFICATION: Modernization of RF transmission systems completed in 30% less time through "BLUE STREAK" team assistance to base maintenance groups.

TEAMWORK IN INSTALLATION: Advanced ECM equipments are installed by "BLUE STREAK"-SAC teams with a minimum of down time. Maintenance and operational training is speeded up, too.

new striking force
for electronic technical support

hallicrafters **blue streak project**

For further information on Hallicrafters facilities and experience in military electronics research, development and production, please write to: THE HALLICRAFTERS CO., MILITARY ELECTRONICS DIVISION, CHICAGO 24, ILLINOIS.

AFCEA Sustaining and Group Members

Communications—Electronics—Photography

Listed below are the firms who are sustaining and group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Sustaining Members

American Telephone & Telegraph Co., Long Lines Department
Cook Electric Co.
General Electric Co., Defense Electronics Div.
International Telephone & Telegraph Corp.
New York Telephone Co.
Radio Corporation of America
Western Electric Co., Inc.

Group Members

Adler Electronics, Inc.
Admiral Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League, The
American Telephone & Telegraph Co.
Amphenol/Borg Electronics Corp.
Anaconda Wire & Cable Co.
Andrew Corp.
Ansco Division, General Aniline & Film Corp.
Arnold Engineering Co., The
Associated Electrical Industries Ltd.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co. Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls Inc.
Bell Telephone Company of Pennsylvania, The
Bell Telephone Laboratories Inc.
Bendix Radio Division, The Bendix Corp.
Bendix Systems Division, The Bendix Corp.
Bliley Electric Co.
Bruno-New York Industries Corp.
Budd Electronics, Inc.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co., The
Cincinnati & Suburban Bell Tel. Co., The
Collins Radio Co.
Columbia Broadcasting System, Inc.
Comptometer Corp.
Contraves Italiana S.p.A.
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Cornell-Dubilier Electric Corp.
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Craig Systems, Inc.
Crosley Division, Avco Corp.
Decca Navigator Co. Ltd.
Delco Radio Division, General Motors Corp.
Designers For Industry, Inc.
Developmental Engineering Corp.
Diamond State Telephone Co., The
Dictaphone Corp.
DuKane Corp.
Du-Mont, Allen B., Laboratories, Div. of Fairchild Camera & Instrument Corp.
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Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
General Dynamics/Electronics, Division of General Dynamics Corp.
General Telephone & Electronics Corp.
Gilfillan Bros. Inc.
GP Engineering Services, Inc.
Gray Manufacturing Co., The
Hallamore Electronics Co.
Hallicrafters Co., The
Haloid Xerox Inc.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hoffman Electronics Corp., Military Products Div.
Hogan Faximile Corp.
Hughes Aircraft Co.
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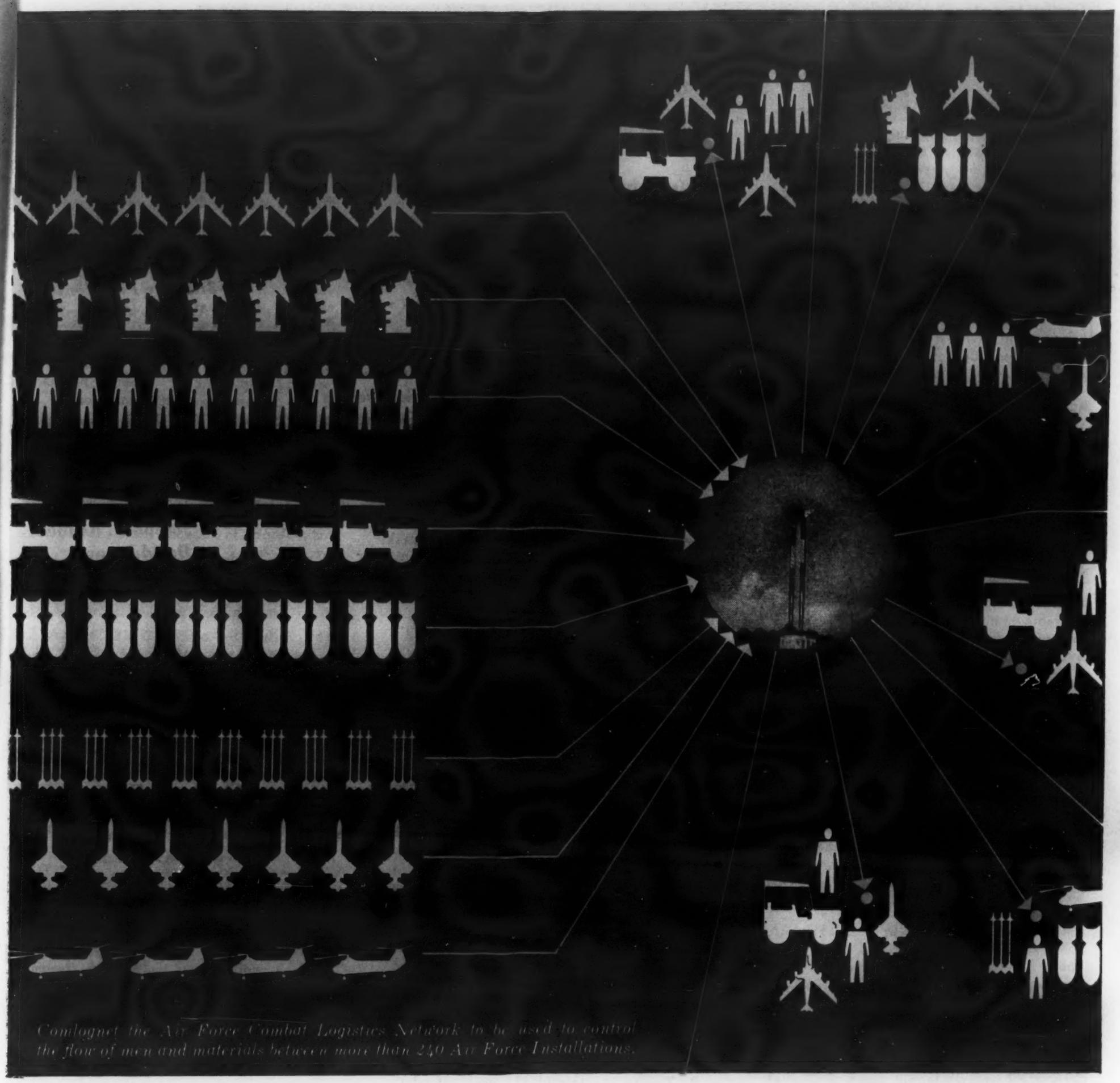

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Chapter News

REGION A

Boston

A dinner-meeting was held January 12 at the Boston Naval Shipyard, Charlestown, Mass. Ninety guests representing thirty-two companies attended. Guest speaker Dana W. Atchley, Jr., president, Microwave Associates, gave an illustrated talk on Inter-Planetary Communications.

Inter-Planetary Communications, the new techniques being applied to achieve usable signals at low power levels, has recently received much public attention. Mr. Atchley was able to provide up-to-the-minute information on this subject.

He questioned how far one would have to go to find life similar to that which we experience on this planet. He said present indications are that there is nothing in our solar system capable of supporting life similar to ours. It appears that the closest solar system where there might be similarity to ours is two stars, eleven light years away. Although attempts have been made to detect any possible electro-magnetic radiation from these stars, as yet there has been no success.

Mr. Atchley went on to indicate that the ultimate may not be in electro-magnetic radiation, but in light, particularly with the development of the LASER type of transmission.

Lexington-Concord

A luncheon meeting was held January 27 at the Carriage House. Guest speaker was the Honorable Brad Morse (R), 5th Congressional District, Mass.

New York

Newly elected chapter president Glenn Montgomery arranged the program for the meeting at the Belmont Plaza Hotel on January 25. Charles Mapes, assistant chief engineer, American Telephone and Telegraph Co., discussed the project Big Bounce and its effect on future world-wide communications.

He discussed many aspects of the successful Echo experiment, as well as the need for satellite communication channels for world-wide telephone, television and data services of the future. Mr. Mapes has had wide experience in communication engineering with present responsibilities for long-range planning, equipping and building engineering and customer telephone products for the Bell System.

Mr. Mapes used a motion picture and slides in his presentation. He pointed out that Big Bounce experiments were successfully evaluated in a two-way circuit operating between Holmdel, New Jersey, and Goldstone, California.

He said that by the year 1980 the rest of the world should equal our U. S. capacity which he anticipates will be in the order of 235 million subscribers. He said that Big Bounce satellite propagation techniques would be cheaper to provide than transatlantic cables and it was reasonable to anticipate international rates to be reduced.

Mr. Mapes said that the American Telephone and Telegraph Co. is proceeding with the development and construction of experimental active satellites of the type it expects to use in a world-wide system. He said "we are now prepared to contract for launching these satellites and proceed with necessary construction of ground stations. AT&T would like to move ahead rapidly and is prepared to spend its money and dedicate its technical know-how to the solution of the many problems ahead in the development of space communications."

Henry Bang was presented with a certificate of appreciation for his two years' service as chapter president. The presentation was made by Lud Engler, RCA Communications.

Northeastern University

Newly elected officers of the chapter are: president, Robert Zaruba; vice president, Richard Garvin; secretary, Martin Feerick, Jr.; treasurer, Thomas Gagnon.

The schedule of activities for the winter term was: November 23, orientation meeting and guest speaker Lt. Col. Sovern, SigC, who spoke on the topic "Italy"; November 30, business meeting to form committees, appoint chairmen and assign projects; December 14, practical exercise, the set-up of a small telephone system; December 21, a field trip to Sylvania Electric Products, Inc., to see MOBIDIC; January 4, "The Tale of Two Cities," a film of the atomic bombing of Hiroshima and Nagasaki; January 11, a film "The Soviet Soldier"; January 18, Col. Evans, PMS at Northeastern University, spoke on "Communications."

The chapter is busy preparing to take motion pictures and tape record the school's biggest social event of the year, the Military Ball.

REGION B1

Philadelphia

A capacity crowd of over 300 attended the January 12 meeting at the U. S. Army Signal Supply Agency to hear R. M. Goetchius, Western Electric Company manager for Project Mercury. He spoke on the problems associated with setting up the tracking sites and the communications needed to put a manned vehicle into space. The talk was illustrated with slides and a motion picture.

National president Benjamin H. Oliver, Jr., was also present and discussed the aims of the Association and outlined some plans for the coming National Convention.

Brig. Gen. Charles S. Hays, who recently succeeded Gen. Littell in command of USASSA, welcomed the group to his installation. Gen. Hays is a vice president of the chapter.

REGION C

Augusta-Ft. Gordon

Richmond County's Civil Defense director, Mrs. G. W. Freiberg, discussed the importance of Communications in Civil Defense at the January meeting of the chapter.

Assisted by F. A. Saxon, Georgia Power Company executive, Mrs. Freiberg told the more than one hundred members present of the administrative and technical problems still to be solved to make Civil Defense more effective. She emphasized the importance of planning for any possible emergency situation.

On display outside the Ft. Gordon Officers Open Mess, where the dinner meeting was held, was the large mobile communications van and power trailer operated by the county C. D. organization. Following the meeting members inspected the van and its 400-watt emergency radio transmitter.

Guests at the head table included Brig. Gen. B. H. Pochyla, STC Commander, and Col. R. R. Creighton, Deputy Commander, both AFCEA national committee members.

Gulf Coast

The chapter held a dinner meeting at the Keesler Air Force Base January 9 with 99 members and guests attending. In addition to a guest speaker, new officers were installed.

Those elected for 1961 are: president, Howard D. Yund; 1st vice president, programs, Maj. John W. Gledhill; 2nd vice president, membership, SMS James F. Musick; secretary, R. C. Cox; treasurer, Miss Christine Smith.

Guest speaker was Lt. Col. Joe Beler (Ret.), formerly department director of Keesler's Radio Operating Department and Ground Electronic Department and now associated with Collins Radio Co. of Dallas, Texas.

Col. Beler showed slides and films explaining Project Short Order, the means by which SAC Headquarters can communicate with any SAC aircraft anywhere in the world. SAC operators dial the desired communications channel on the telephone dial and the telephone lines, radio antennas and receivers automatically connect and make ready the operation within seconds.

Col. Beler was assigned to the Operations Division of SAC Headquarters, Offutt AFB, Nebraska, before his retirement.

Northwest Florida

Thirty members and guests attended the January 20 meeting at Angelo's Restaurant, Panama City. Leonard Ruggles, chief engineer, Wirecom Division, Cook Electric Company, Chicago, Ill., addressed the group.

Mr. Ruggles spoke on telephone protective devices currently in use, and showed a film which described the present and future uses and advancements in telephone protective devices.

Yearly election of officers will take place at the March 17 meeting to be held at Fort Walton Beach.

REGION D

South Texas

Newly elected officers of the chapter are as follows: president, Col. Alvin Burke, SigC; vice presidents, Edwin S. C. Coppock, Col. Hugh Moreland, J. D. Rainbolt, Lt. Col. William Jackson; secretary, Wilbur Gillum; treasurer, George Bristow.

Directors of the chapter are Maj. Gen. Millard Lewis, Maj. Gen. H. Reichelderfer, Col. Ed Houghton, Col. Robert D. Easters, L. H. Hudson, Oscar Screws, and Steve Simpson.

White Sands Missile Range

On December 21 the chapter elected the following officers for 1961: president, Scott D. Cozby; 1st vice president, Harold A. Lambeth; 2nd vice president, William M. Balentine, Jr.; secretary, Charles E. O'Meara; treasurer, Clarence M. Decker.

REGION E

Decatur

A business meeting was held at the Decatur Signal Depot, Myer Hall, on January 31. Following the meeting, chapter president Captain Lacey showed slides on Thule, Greenland, the Arctic, and aerial views of the North Pole.

Scott-St. Louis

Guest speaker at the January 6 dinner meeting was Captain J. K. Hyatt, USNR, vice president, engineering, Anheuser-Busch, Inc. He was introduced by Comdr. George W. Laidlaw, USNR, Commercial Department, AT&T, St. Louis. The meeting, held at Augustine's Restaurant, was attended by 107 members and guests.

Capt. Hyatt spoke on "The Cold War—Its Impact on the Home Front." He discussed the Communist influence around the world and in turn the influence it has on our own domestic affairs and policies.

February 3 Dr. Robert E. Beam, professor of E. E. at Northwestern University and Consultant (R&D) for The Hallicrafters Company, spoke on "Putting Satellites to Work in Communications."

REGION F

Arizona

The chapter held its second meeting of the current year at the Ft. Huachuca Officers Club on January 20. Some 100 members, their wives and guests attended. Cosponsor of the meeting was IBM.

Speaker for the evening was Robert P. Crago, manager of IBM's Federal Systems Division, who spoke on "Communication Meets Its Master."

Mr. Crago pointed out how the infant of the electronics field, the data processor, has challenged the communications industry as a source of new development. He outlined how data processing techniques have been found to be the answer to longstanding problems of controlling communications systems. Going back to early examples, Mr. Crago plotted the history of the development of communications control by data processors and emphasized future possibilities which well may revolutionize the communications field.

In March the chapter will hold its meeting at the Davis-Monthan Air Force Base in Tucson, where the cosponsor will be RCA.

Greater Los Angeles

A meeting was held January 18 at the Statler Hilton, Golden State Room. Guest speaker Lt. Gen. Francis H. Griswold, USAF, spoke on "Strategic Air Command and the Role of Communications." Gen. Griswold, vice commander-in-chief of Strategic Air Command, has been at his present assignment for six years.

Chapter president John W. Atwood has announced that future meetings will be held March 15 and May 17.

General Griswold said that the primary mission of SAC is to preserve the peace. It is a challange in commanding and controlling the Air Force's most formidable and diverse force in preventing Mr. Khrushchev from pushing the war button. SAC's sophisticated communications are of all forms including radio, all types and frequencies, private line telephone and teletypewriter, switching keys, buzzers and lights. All of these go to keeping a 24 hour every day "Fail Safe" deterrent to starting a "hot" war.

San Francisco

A dinner meeting was held at Fort Mason Officers Open Mess on January 27. Guest speaker was Col. Albert J. Mandelbaum, USA, SigC (Ret), who discussed "NATO Communications."

During a 30-year career with the Signal Corps one of Col. Mandelbaum's outstanding achievements occurred as chief of Telecommunications Branch, Signal Division, Supreme Headquarters Allied Powers Europe, in Paris, France. Through his efforts a seventy-eight million dollar Forward Scatter Communication System spanning the European continent was approved by the North Atlantic Council of NATO, and subsequently established.

Col. Mandelbaum explained the newly established ionospheric and tropospheric forward scatter systems, which extend from Norway through Western Europe to East Turkey. These systems are owned and controlled by SHAPE, the military headquarters within the NATO alliance. These systems supplement the natural communication networks and provide for the critical command communications between SHAPE and its subordinate echelons.

Seattle

W. Wayne Killinger, engineer, Pacific Telephone—Northwest, was guest speaker at the January 11 dinner meeting. Thirty-six members and guests attended the meeting held at the Benjamin Franklin Hotel.

Mr. Killinger gave a presentation on the use of microwave by the Bell System. His lecture, which included the use of mockups and illustrations, also featured technical excursions designed to brief the engineers on new microwave developments. An actual miniature microwave circuit was set up and used to demonstrate the effects of wave polarization and the importance of proper antenna focusing. The properties of various types of waveguides were also discussed.

EUROPEAN REGION

Paris

Chapter president Major General Frank W. Moorman, Chief Signal Officer, SHAPE, gave a presentation of the U. S. Army Signal Corps Research and Development program at the December 6 meeting. Ninety-three members and guests attended the dinner meeting.

The talk, which was presented in both English and French, included color slides. General Moorman described various types of Signal equipment now under development.

PACIFIC REGION

Marianas

The December 15 meeting held at the Breakers Club was sponsored by the U. S. Navy. There were 67 members and guests present. Capt. C. John Alley, USN, commander, Naval Communications Station, who is the Senior Military Communicator on Guam, was elected president of the chapter.

Other officers elected for 1961 are: executive vice president, Major Frank A. Wall, USAF; vice president, programs, Harry Engel, KUAM radio and TV, vice president, membership, John Welch, FAA; secretary, Lt. Cmdr. Walter Scott, USN; treasurer, 1st Lt. Joseph Anderson, USAF.

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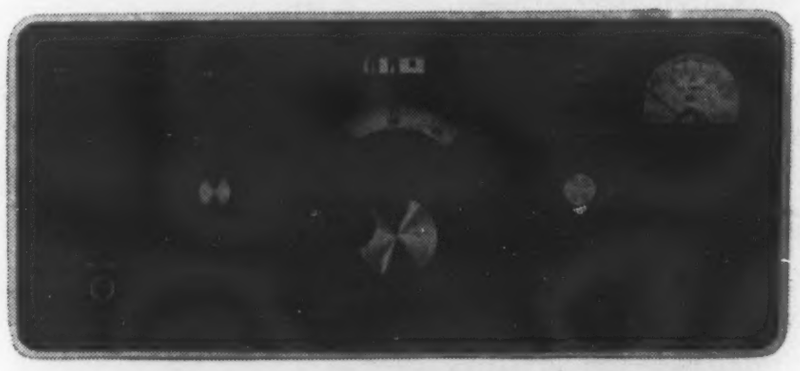

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New York—(photo left) At the January 25 meeting: (L to R) newly elected chapter vice president Frank Gunther, Radio Engineering Laboratories; president Glenn Montgomery, AT&T Long Lines; guest speaker Charles Mapes, assistant chief engineer, AT&T; Henry Bang, outgoing chapter president. (photo right) **Northeastern University**—Newly elected officers are: (L to R) Richard Garvin, vice president; Martin Feerick, secretary; Robert Zaruba, president; Thomas Gagnon, treasurer.

Augusta-Ft. Gordon—(photo left) Guest speaker at the January meeting Mrs. G. W. Freiberg, Richmond County Civil Defense Director, with chapter president Col. Thomas J. Trainer and F. A. Saxon, Georgia Power Co. (photo right) **Scott-St. Louis**—At the January 6 meeting: (L to R) guest speaker Capt. J. K. Hyatt, USNR, vice president, engineering, Anheuser-Busch, Inc.; chapter president Col. D. W. Baugher; and Mr. Walters, comptroller, Anheuser-Busch, Inc.

Gulf Coast—(photo left) Newly elected officers of the chapter are: (front row, L to R) treasurer, Miss Christine Smith; president, Howard D. Yund; vice president for programs, Maj. John W. Gledhill, Jr.; (back row, L to R) secretary, R. C. Cox; vice president for membership, SMSgt. James F. Musick. (photo right) **Atlanta**—At the November 29 meeting: (front row L to R) Brig. Gen. W. H. Wise, board of directors; guest speaker Harold S. Black, Bell Laboratories; Ben Gilmer, board of directors; (back row, L to R) Kelly Mosley, board of directors; John S. Seigle, president; guest, L. G. Rodefeld, Delta Airlines.

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from ground to aircraft is achieved
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The North American Air Defense Command Combat Operations Center maintains world-wide communications with the Commander-in-Chief, NORAD, through the NORAD Single Sideband Air/Ground Station, operated by the 47th Communications Squadron at Peterson Field, Colorado Springs, Colorado. It also provides a vital world-wide communications link for ADC, MATS, SAC and others engaged in the defense of our country.

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Boston—(photo left) At the January 12 meeting Dana W. Atchley, Jr., president, Microwave Associates, explains the intricacies of a Parametric Amplifier. Pictured are (L to R) chapter director, Robert Richmond, Mr. Atchley and chapter president Louis Dunham. (photo right) **Arizona**—At the January 20 meeting: (L to R) Col. Otto Saar, chief of staff, USAEPG; guest speaker Robert P. Crago, International Business Machines; Col. Charles H. Burch, deputy commander, U. S. Army Electronic Proving Ground.

Association News

Executive Committee Meets

A quarterly meeting of the AFCEA Executive Committee was held January 26 in Washington, D. C. Among items of business was the appointment of two new regional vice presidents and the appointment of Robert B. Richmond, General Radio Co., to replace Glenn Montgomery, recently elected president of the New York chapter, as Region A vice president.

Brigadier General Kenneth F. Zitzman, USA (Ret.) is regional vice president of the European Region which includes the chapters of Frankfurt, London, Paris and Switzerland. Regional vice president of the Pacific Region is Major General Gordon A. Blake, USAF. Chapters include Hawaii, Korea, Marianas, Okinawa, Philippine and Tokyo.

Other subjects covered were: the 15th Annual AFCEA Convention; special March Air Force issue of Signal; and the nominating committee selections for 1961.

As We Go To Press

The Middle Georgia chapter, at Warner Robins, Georgia, received its charter on February 14 and the Pensacola chapter in Florida was chartered February 22. Hogan Faximile Corp. is a new group member.

Pan American World Airways Joins Association

Pan American World Airways, Inc., Guided Missile Range, Electronic Environmental Test Facility Project has joined the Association. The group will be associated with the Arizona chapter of AFCEA.

H. F. Jacobson, project manager, will act as company representative. Others named to membership are: R. M. Gramling, assistant project manager; E. L. Johnson, program management manager; H. E. Redding, engineering manager; J. H. Lenhart, instrumentation manager; J. Ewing, program engineer; Glen Lockhard, area operations manager; E. B. Worthington, communications engineer; W. Wrigglesworth, communications supervisor; R. Reed, operations manager.

GP Engineering Services, Inc. Becomes New Group Member

GP Engineering Services, Inc., an organization which offers engineering talent and publication facilities, has joined the Association. Chris Behrens, vice president, New York Division, will act as company representative.

Those named to membership are: Al Seltzer, department manager GP, Philadelphia; Beryl Wolk, vice president GP, Philadelphia; Leonard Lucas, vice president GP, Philadelphia; Jack Silver, office manager GP, Philadelphia; George Sincerny, office manager GP, New York; Robert Davis, sales manager, New York; Milt Slotnick, sales manager, Philadelphia; Milton Wood, manager, Technical Writing, New York; Ivan Sohonyay, manager, Communications Engineering, New York.

In Memoriam

The Association is sorry to report the recent death of a respected and admired friend. Theodore L. Weyn, an executive in the Department of Labor, will long be remembered for his efforts in furthering the aims and objectives of AFCEA. He served with outstanding merit. We extend our sympathy to his family.

Col. K. E. Shiflet Receives Medal

Lt. Col. Kenneth E. Shiflet was recently awarded the Army Commendation Medal for gaining "invaluable new prestige for the Army Signal Corps and greater public appreciation of the importance of its mission and accomplishments." The award was presented by Maj. Gen. R. T. Nelson, Chief Signal Officer, at a Pentagon ceremony.

Col. Shiflet has held the post of Technical Liason Officer since August 1957. He was a contributing editor to SIGNAL magazine during his assignment in Washington. His valuable aid as liason on behalf of AFCEA will long be remembered. He has been reassigned to the Armed Forces Staff College, Norfolk, Va.

Maj. Gen. R. T. Nelson, CSigO, (second from left) with Lt. Col. K. E. Shiflet and family following presentation of the Army Commendation Medal.

NEW MEMBERS

Listed below are new members of the AFCEA who have joined the Association during the month of January. Members are listed under the chapter with which they are affiliated. Amateur radio operators are listed with their call letters.

Alaska

William O. Baughman
Gordon S. Bell
Merle W. Berrie
Arthur E. Broeg
Maj. William J. Brown
Bobby G. Burnett
Fred D. Chiei, Jr.
Capt. J. A. Crowley, USAF
Frank R. Cuda
Lt. Col. V. E. Daniel, USAF
1st Lt. Oscar G. Diessner, Jr.
Kenneth L. Eaton, K50KK
James O. Ekstodt
Lt. Col. H. O. Flathmann, USAF
Thomas A. Galloway
Thomas C. Harris
Allan J. Holbrook
Lt. Col. John R. Horne, USAF
Cmdr. E. C. Humphres, USAF
Cmdr. G. E. Kempler, USN
Samuel H. Kimball
E. C. McCollough
Robert J. McGrane
John P. Mowen
Maj. Edward F. Nassoiy, USAF
Howard E. Nestlerode
Paul E. Patterson
Charles J. Schrey, Jr.
Col. Charles A. Thorpe, USAF
Carrel W. Uptergrove
CWO Manuel D. Vital
Angus R. Wilmoth
Robert C. Young, EX-W50RL
Robert T. Young
James L. Zehner

Arizona

O. M. Akey
J. Ewing
R. M. Gamling
H. F. Jacobson
E. L. Johnson
J. H. Lenhart
Glen Lockhard
H. E. Redding
R. Reed
Richard Lee Van Tilburg
E. B. Worthington
W. Wrigglesworth

Atlanta

James D. Baer
Sam J. Elliott
William F. Gannon
Cecil J. Johnson
William Y. Joyce, K4VPJ
Donnell Murray
George S. Schultz

Augusta-Ft. Gordon

Thomas J. Carswell
Thomas J. Corrigan
Neal M. Dunn
Kermit A. Falk
SFC Henry P. Fletcher
Clifford Juan Herzberg
Lt. Richard H. Howes, USA
Robert E. Hughes
2nd Lt. W. M. Kirk, Jr., USA
Robert L. Longshore, Jr.
Walter F. McDonald
James W. Minchew
Lt. Anthony J. Ricciardi
Capt. Felix S. Satey
Charles A. Stewart
Capt. Joseph D. Strowd
Sgt. A. V. Sullivan, USA
Walter S. Williams
W.O. Michael M. Winkler
Cornelius Zwart

Baltimore

Walter A. Carlson
John N. Johnson
Robin B. Pape

Boston

Richard D. Burton
Edwin B. Dallin
John E. McDevitt
Joseph M. Van Horn

Cape Canaveral

Ralph L. Evans

Chicago

William Arrott
Lt. Col. E. G. Davis, USAR
Lawrence F. Douglas
Philip G. Eckert
Carroll W. Hanna
Ralph G. McNeil
Irving Moss
Walter Witte

Dayton-Wright

Ellwood E. Cook
John E. Wilkinson

Decatur

Sam Akman
Donald Allison
Donald Kenneth Allison
Alan Anderson
Carl Ballhorst
Leslie Brown
Loren E. Cox
Robert D. Cruthis
Roger Fulk
Roy Groves
Ronald H. Hunter
Thurman A. Lambirth
David McClure
Mel Mellinger
Max A. Napierski
Thomas Radley
Dave Kent Roberts
Stanley H. Roberts
W. J. Semelka
John W. Snow
Elmer T. Soden
Tom Soden
Robert Soloman
Lamar J. Sparks
John Todd
Ruth A. Wilber
Stanley E. Wilber

Ft. Monmouth

Stanley Blumstein
Albert W. Bush
Robert G. Douglas, Sr.
Charles Evans
Robert N. Griggs

Frankfurt

1st Lt. Earl N. Dunn

Greater Los Angeles

Warren V. Boughton
T. J. Cunningham, W6PIF
John Ellis Edwards
William M. Ferguson
Harold W. Foster
James V. Guthrie
Alfonzo J. Izzo
Robert C. Jackson, K6GWH
William G. Jackson, Jr.
Chris C. Larson
R. B. Leng
Raymond B. Morgan
Bruce W. Prestwich
Maj. W. L. Sandidge, USAF
Hans M. Schniff
Howard F. Shepherd, Jr.
Thodore J. Sokol
Maj. Jess Uslan, USAR

Gulf Coast

Dovel Boles
Capt. F. W. Doherty, USAF

Kansas City

Gerald D. Franklin
Lt. Col. L. E. Johnson, USA
Wayne L. Miller
Carl H. Sapper, Jr.
John R. Stein
Sgt. George Stephens

Korea

Ray Holthaus

Lawton-Ft. Sill

James R. Lucas

Lexington-Concord

Col. David H. Barger, USAF
Maj. Ralph E. Bickerton, USAF
Col. R. E. Bohan, Jr., USAF
Edward M. Colbert
Robert L. Ewing, Jr.
Grady C. Holt
J. Cabot Lyford
Col. J. D. Nottingham, USAF
Albert G. Patard
John P. Retelle, K1OVH
William R. Toye

Louisiana

Will S. Temple, Jr.

Montgomery

George W. Hails

New York

Chris Behrens
Wolfram R. Cisenius
James R. Coleman
Harry B. Coxhead
Lt. Col. C. Davidson, USAFR
Robert Davis
William A. Enterline
Robert Arthur Hauck
Albert G. Hebling
Lt. Col. Carlos F. Molina
Robert F. Nickel
David S. Rau
David F. Sanders
Irving Schneider
George Sincerny
Ivan Sohonyay
Abraham Henry Sonnenschein
Henry L. Tate
John W. Welland, WA2CTQ
Milton Wood

North Carolina

Wiltshire M. Booker, Jr.
John F. Moore
Oscar L. Smith

North Texas

Jay E. Adams
Elbert L. Barton
Dr. Donald R. Herzog
Richard B. Howes, Jr.

Northeastern University

Capt. William J. Hilsman

Northwest Florida

ETC Charles A. Beam
Bobby H. Bunch
Robert T. Camp, Jr.
Danny N. Davis
Capt. Jack E. England, USAF
John R. Forstall
James W. Greene
Walter H. Leveille
Troy L. Lindsey, W4IHH
George E. Mead, (X) XN4UW
Scott N. Morrill
Ernest T. Quimby
John L. Toole, III
John G. Werner, K4SOI

Okinawa

Sasa Hiroshi
Donald W. Matteson
Gerald A. Michell
Arakawa Tadasuke

Orange

John W. Argo, Jr.
Brig. Gen. D. K. Yost, USMC

Paris

Maj. Bernard C. Deloiser
Lt. Col. John Horvath, USAF
1st Lt. Joseph A. Rita
Col. Leon J. D. Rouge, USA
M. Sollima

Philadelphia

Victor E. Balant
Edwin O. Brown
C. H. Candy
Myron Frankel
Dennis F. Furey
J. Raymond Groff
Robert John Irvin
Joseph William Kopesky
Leonard M. Kravitz
Leonard Lucas
1st Lt. H. A. Montgomery, USA
Lt. Col. W. D. Morgan, USMC
Col. Robert M. Perry, USAF
Wellington Greeley Rodgers

George John Schneider, III
Al Seltzer
Jack Silver
Milt Slotnick
Cmdr. C. A. Snay, USN, W2WBV
William F. Sweeney
Louis J. Troilo
Beryl Wold
Nathan Zauzner

Pittsburgh

Col. Robert Disney
Harry D. Young

Rocky Mountain

Fred V. Nichols
Charles H. Reeve
Daniel F. Shea, Jr.
Antonio J. Zarlenga

Rome-Utica

Leopold Sternlight
John J. Ward
R. F. Weil

San Diego

Raymond A. Gordon

San Francisco

Martin Grushkin
Capt. George M. Peterson

San Juan

Robert A. Kitchener, KP4AIX
Capt. Thomas E. Little, Jr.

Santa Barbara

Rev. Alexander G. Manville

Scott-St. Louis

Harry R. Beerbower
Alvin C. Calderwood
Richard Clifford Haskel

Seattle

Capt. Lester M. Hill, USN
Reuben H. Waldron

South Texas

Kenneth B. Matthews
Stuart J. Yuill

Southern Connecticut

Cmdr. Joseph W. Catharine, Jr.
S. H. Kaufman, W1VIJ

Syracuse

Donald E. Barg
Kenneth G. Bartlett
Robert E. Davis
Joseph R. McElrath
Keith W. Mattison
John T. Robinson

Tinker-Oklahoma City

Carl W. Eastman

Tokyo

Lt. Gilbert H. Beckwith, USN
Leonard C. Chambers, USN
Lt. Robert C. Doyle, USN
Maj. James M. Dunn
Tor D. Folkedal, USN
Lt. (jg) Elizabeth B. Glover, USN
Capt. Walter H. Kreamer, USN, EXN9AGC
V. F. Scalamander, RMCS, USN
Lt. Wallace E. Trelford, USN
Howard F. Van Zandt
Maj. Chihiro Yamano

Washington

Maj. Robert V. Anderson, USMC
Robert W. Boyle
James J. Hanks
Lt. Cmdr. W. J. Healy, USNR
Paul M. Jamesson
1st Lt. Raymond E. B. Ketchum
Charles D. LaFond
Roy S. Luxemburg
Thomas J. O'Brien
Jack E. Scott
Lt. Cmdr. C. R. Winnette, USN
Roger W. Yeomans

Members At Large

Giancarlo Antinori
L. A. Damasio
Elvis Leon Evans
Capt. Edward J. Hayes, USAR, W2CJH
Capt. Albert E. Hodsdon, Jr.
D. Jodoin
Billy H. Terrell

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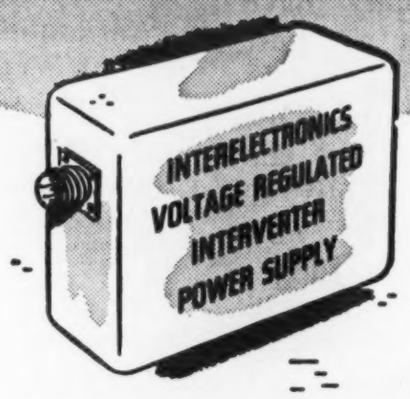

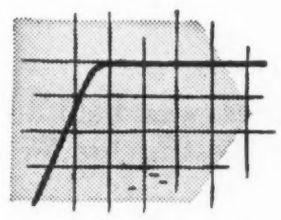

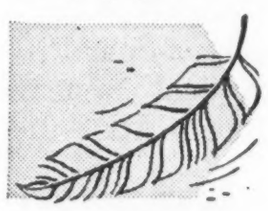

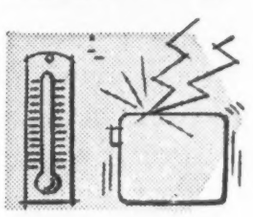

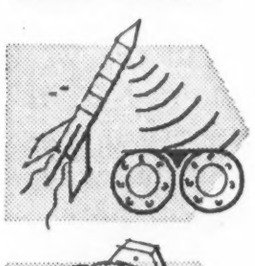

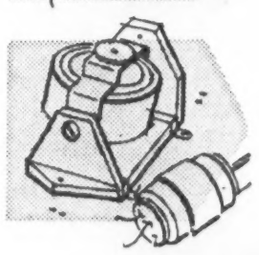

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AC single and polyphase units supply sine waveform output (to 2% harmonics), will deliver up to ten times rated line current into a short circuit or actuate MIL type magnetic circuit breakers or fuses, will start gyros and motors with starting current surges up to ten times normal operating line current.

Now in use in major missiles, powering telemeter transmitters, radar beacons, electronic equipment. Single and polyphase units now power airborne and marine missile gyros, synchros, servos, magnetic amplifiers.

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NEWS ITEMS AND NEW PRODUCTS

Two radio hams, whose trans-Pacific experiments have set distance records and opened new horizons in UHF communications, shared the 1961 Edison Radio Amateur Award sponsored by General Electric. (See SIGNAL, December 1960, page 60.)

John T. Chambers, W6NLZ, a satellite communications project leader for Hughes Aircraft Corp., and Ralph E. Thomas, KH6UK, engineer-in-charge of an RCA communications transmitting station in Hawaii, were presented the award by L. Berkley Davis, General Electric vice-president, at a banquet in Washington on February 23.

A cash prize and trophy have been awarded annually for the past nine years for outstanding public service by a radio amateur. This year marks the first time that the award has been granted jointly to two amateurs, and also the first time for a scientific achievement. Judges for the award were FCC Commissioner Rosel Hyde; Robert C. Edson, American National Red Cross; and, F. E. Handy, American Radio Relay League.

On July 20, 1960, Chambers and Thomas set a one-way communications record of 2,540 miles on 432 megacycles. This and earlier records set over the same California-to-Hawaii course, on 220 and 144 megacycles, confirmed the theory that UHF radio communications were not limited to line-of-sight, thanks to tropospheric ducting.

• • •

The Business and Defense Services Administration, U.S. Department of Commerce, summarizes the outlook for 1961 and review of 1960 for the communications industry as follows.

Domestic and foreign sales of the communications equipment manufacturing industry in 1960 will amount to $2.93 billion—slightly higher than earlier estimates—establishing another all time high. According to the industry, sales in 1961 are expected to show a moderate decrease from 1960. Industry reports indicate a downward trend for the first 3 quarters of 1961, followed by a substantial rise in the fourth quarter. Employment in the industry may decrease somewhat in 1961 compared to 1960. Sales to the Government for materials used mainly for national defense projects will represent approximately 30 per cent of the over-all 1961 total.

The commercial central station protective signaling industry expects another record year in 1961, surpassing by 6.5 per cent the earned revenue mark of $70 million in 1960. In 1960, the industry expanded its building construction program to about $14 million to accommodate the backlog of orders. It is anticipated that about the same pace in construction will continue through 1961, and employment also will increase substantially.

Revenue of the domestic telegraph industry in the first nine months of 1960 amounted to $207 million, and the projected total for the year will approximate $275 million, nearly equivalent to that in 1959. The industry expects capital expenditure requirements to amount to $150 million in the 1960-61 period. Increased private wire usage and expansion of teletypewriter exchange service account for the expected growth.

• • •

A series of briefings was held in January for the unsuccessful bidders for the Communications/Data Link and the Primary Guidance Subsystems contracts for the Dyna-Soar Program by the Aeronautical Systems Center at Wright-Patterson Air Force Base.

Colonels E. N. Odell and L. T. David, responsible for the contract proceedings for the Dyna-Soar Subsystems, conducted the briefings. The various firms in competition for the two contracts were advised of the general structure and procedures of the source selection panel and the weak and strong points contained in the various proposals. Numerical positions of the firms in the final evaluations were not revealed to the companies present for the briefings.

The Radio Corporation of America was awarded the contract for the Communications/Data Link Subsystem in a ten-firm competition while the Minneapolis-Honeywell Regulator Company was awarded the Primary Guidance Subsystem contract in competition with eleven other companies. Both contracts were cost plus fixed fee types. The Communications/Data Link award amounted to $2.4 million with the Guidance contract amounting to $2.7 million. Both covered the first six-months efforts of the companies involved.

According to Major General W. A. Davis, Aeronautical Systems Center's Commander, the critiques were believed appropriate "in view of the need for improvement in the quality of future proposals as well as in consideration of the magnitude of effort expended by the twenty-two companies entered in the subsystem competition for the Dyna-Soar program." General Davis emphasized that these conferences do not establish a precedent and that future critiques will be conducted only when mutual Air Force-Industry benefits will result.

• • •

Selection of four companies to engage in a four month study designed to investigate the feasibility of an advanced space tracking antenna has been announced by the California Institute of Technology Jet Propulsion Laboratory. The four companies selected on November 7 are: Westinghouse Electric Corp., East Pittsburgh, Penn.; Blaw-Knox Equipment Div., Blaw-Knox Company, Pittsburgh, Penn.; Hughes Aircraft Company Ground Systems, Fullerton, Calif.; and, North American Aviation Inc., Columbus, Ohio.

Each of the four companies will submit to JPL by late spring a design analysis of a large tracking antenna from 200 to 250 feet in diameter. At present, the three Deep Space Instrumentation Facility (DSIF) stations at Goldstone; Woomera, Australia and the one being constructed at Krugersdorp, South Africa, employ tracking antennas 85 feet in diameter. If technically and financially feasible, the advanced antennas would increase the DSIF communications capability 10 to 30 times.

• • •

The U. S. Naval Research Laboratory will build a 560,000 watt Space Surveillance System 35 miles southwest of Wichita Falls, Texas this year. The powerful transmitter is being supplied by the Radio Corporation of America and the mile-long transmitting antenna by Antenna Systems Incorporated of Hingham, Massachusetts. The RCA equipment,

composed primarily of standard commercial transmitter equipment modified and arranged to meet the Navy's requirements, will feed power into the antenna. The latter will consist of nine sections—each measuring approximately 576 feet long by 24 feet wide—arranged so that one can be inoperative without affecting the others.

The present Navy Space Surveillance System was built by NRL and has been in operation for two and one-half years. The system has two complexes—the eastern complex extending from Georgia to the Mississippi River and the western complex stretching from California to New Mexico—with a blind spot between them. Satellites which can now make an undetected pass between the two complexes will be spotted by use of the new transmitter station, working with the existing receivers.

• • •

At a special session of the American Meteorological Society last January, it was reported that Tiros II is providing a wealth of weather information. The meeting was held under the chairmanship of Dr. Morris Tepper, chief of the meteorological satellite program of NASA.

The infrared equipment aboard the satellite has been in continuous operation since its launching on November 23, 1960 and is still functioning. The 5-channel, medium-resolution scanning radiometer is sending about 60 data points for each orbit, showing a detailed temperature structure of the earth's surface and its atmosphere. At the same time, the two-channel, low-resolution radiometer is measuring the average reflected solar radiation, as well as the long-wavelength energy emitted by a large area directly below the satellite.

Close to six million measurements are being received with each passing day. The information is stored on magnetic tape for subsequent processing and interpretation. When coupled with known positions and orientations of Tiros II, these data clearly show the temperature structure of the earth and its atmosphere, as seen from a vantage point 400 miles in space.

According to Dr. Rudolph Hanel of NASA's Goddard Space Flight Center, temperature data gathered during the first several hundred orbits are being reduced by hand. He emphasized, however, that as soon as methods of analysis and programming have been worked out and confirmed, a high-speed digital computer at the U. S. Weather Bureau will handle this task of data reduction. The millions of individual measurements made by Tiros II can then be used to prepare accurate weather maps.

A miniature of the Nike-Zeus is examined by guests at a dinner honoring the National Press Club's new president, John P. Cosgrove. From L to R: Maj. Gen. Wm. W. Quinn, Army Chief of Information; Speaker of the House, The Honorable Sam Rayburn; Chief Justice Earl Warren, and Mr. Cosgrove, Director of Publications for Broadcasting Publications, Inc.—U. S. Army Photo.

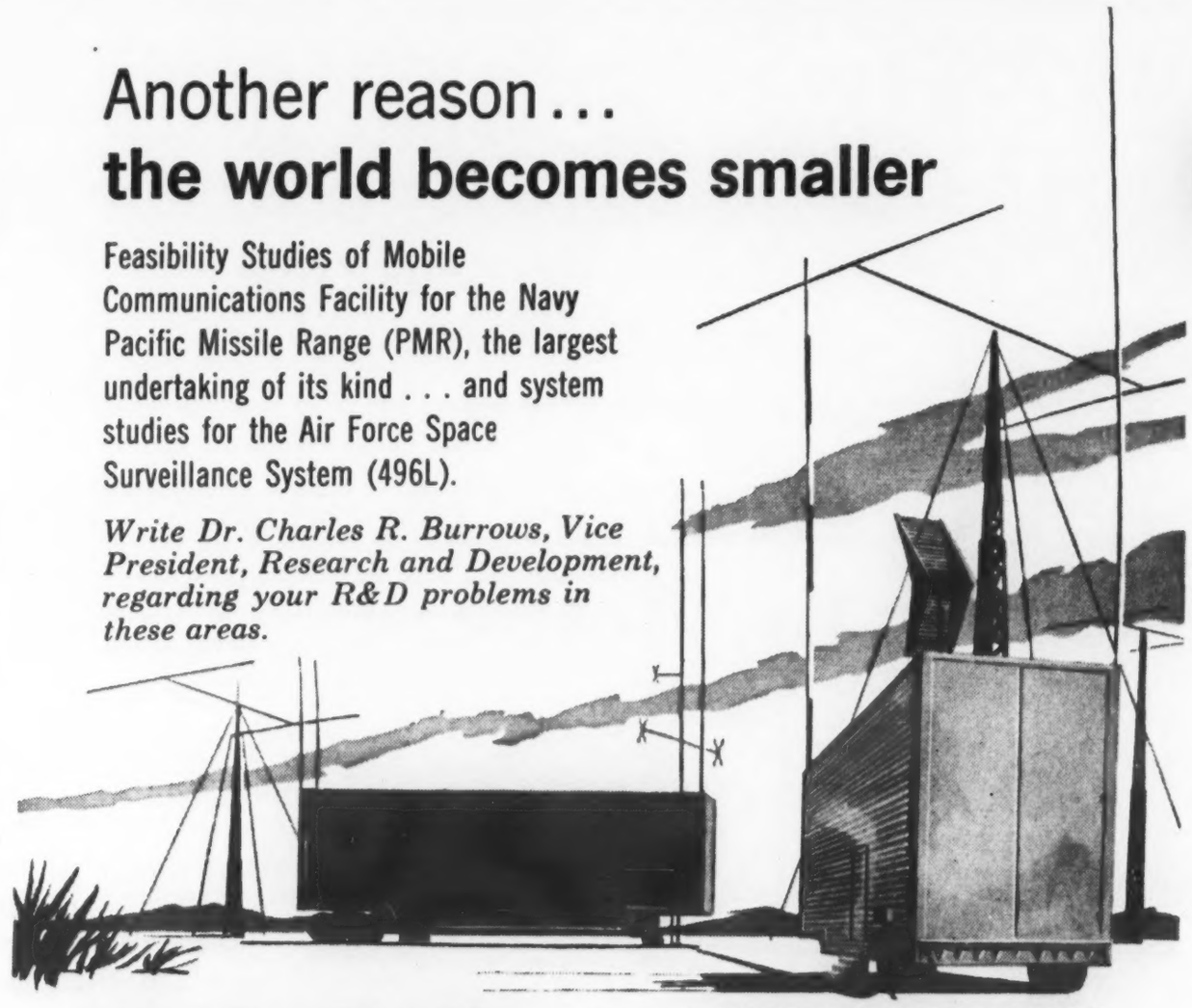
Preliminary analysis of data from early orbits revealed temperatures ranging from about 280°K (45°F), typical of surface temperatures in moderate zones, to a low of 220°K (—65°F) existing at cloud levels at the top of the troposphere. These measurements were made by one channel of the five-channel radiometer, filtered to the 8-13 micron

(*Continued on page* 71)

Another reason...
the world becomes smaller

Feasibility Studies of Mobile Communications Facility for the Navy Pacific Missile Range (PMR), the largest undertaking of its kind . . . and system studies for the Air Force Space Surveillance System (496L).

Write Dr. Charles R. Burrows, Vice President, Research and Development, regarding your R&D problems in these areas.



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AN ACHIEVEMENT IN DEFENSE ELECTRONICS

HIPAR Proves Effective In Hercules Anti-Missile Test

This new General Electric *High Power Acquisition Radar* (HIPAR) more than triples the detection capability of the U. S. Army's Nike-Hercules System. Produced for Western Electric, Nike-Hercules System Prime Contractor, this General Electric radar provides high resolution target data at long range and high altitudes on bomber and fighter aircraft, air-launched missiles and tactical ballistic missiles. The effectiveness of this Improved System was demonstrated at the White Sands Missile Range on June 3, 1960, with the successful intercept and destruction of a Corporal Missile, and in August and September, 1960, when target Nike-Hercules Missiles were destroyed by their defending counterparts at altitudes to almost 100,000 feet and closing speeds near Mach 7. 176-06

HEAVY MILITARY ELECTRONICS DEPARTMENT
DEFENSE ELECTRONICS DIVISION • SYRACUSE, NEW YORK

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atmospheric "window."

To check on the reliability of the infrared temperature measurements, Tiros II information was superimposed on weather maps produced by conventional and independent means. Correlation, particularly in a detailed plot of the southwest Pacific, was found to be very close.

• • •

Four more 5-day Staff College Courses in Industry Defense and Mobilization have been scheduled for 1961 at the Office of Civil and Defense Mobilization National Operational Headquarters, Battle Creek, Michigan. Dates for the courses are: March 20-24; June 12-16; September 25-29; and November 13-17.

Top-flight operating executives from industry who have the "have done—know how" experience in their own organizations serve as guest lecturers, workshop and panel discussion leaders. Teamed with these men are staff instructors who are experienced leaders in their field of Emergency Preparedness Planning and Disaster Control Work in Industry.

The course is open to all who have responsibility for Emergency and Disaster Control planning and related responsibilities in industry, institutions and other large facilities. There is no charge for tuition. In addition to local hotel accommodations, modern, well appointed and comfortable single rooms are available to students at the OCDM Headquarters at $1.50 a day. Enrollment for the courses or requests for additional information may be directed to the Industry Office, OCDM, Battle Creek, Michigan.

• • •

A realignment of the U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona, has been announced by the Office of The Chief Signal Officer. No increase or reduction in the size of the work force at Huachuca is expected as a result of the action, which will be accomplished over a period of 12 to 16 months. Purpose of the realignment is to shorten the delivery time on newly developed equipment for use by combat troops.

The Directorate concept, now in effect at the Proving Ground, will be replaced by a general staff arrangement, used at most other military installations. The Combat Developments Directorate, which was the heart of the technical elements of the Proving Ground, will be reorganized into a System Development and a Field Test element. The existing Troop Command will be combined with the many post functions and will be redesignated the Support Command.

The realignment is being implemented by an ad hoc committee composed of key military and civilian personnel.

• • •

On November 19, 1960, the most violent ionospheric storm ever recorded in Antarctica subsided opening the frozen continent to communications after over 132 hours of utter isolation and intermittent periods of blackout for another 72 hours.

Operation Deep Freeze, the U.S. Navy's support program for American scientific probings in Antarctica, immediately accelerated its flight program and other activities after six days of waiting. At McMurdo Sound, preparations for the end of the storm continued throughout the blackout. Good flying weather prevailed there all through the magnetic disturbance, but no radio contact meant no flying.

The communications blackout is

(*Continued on page* 73)

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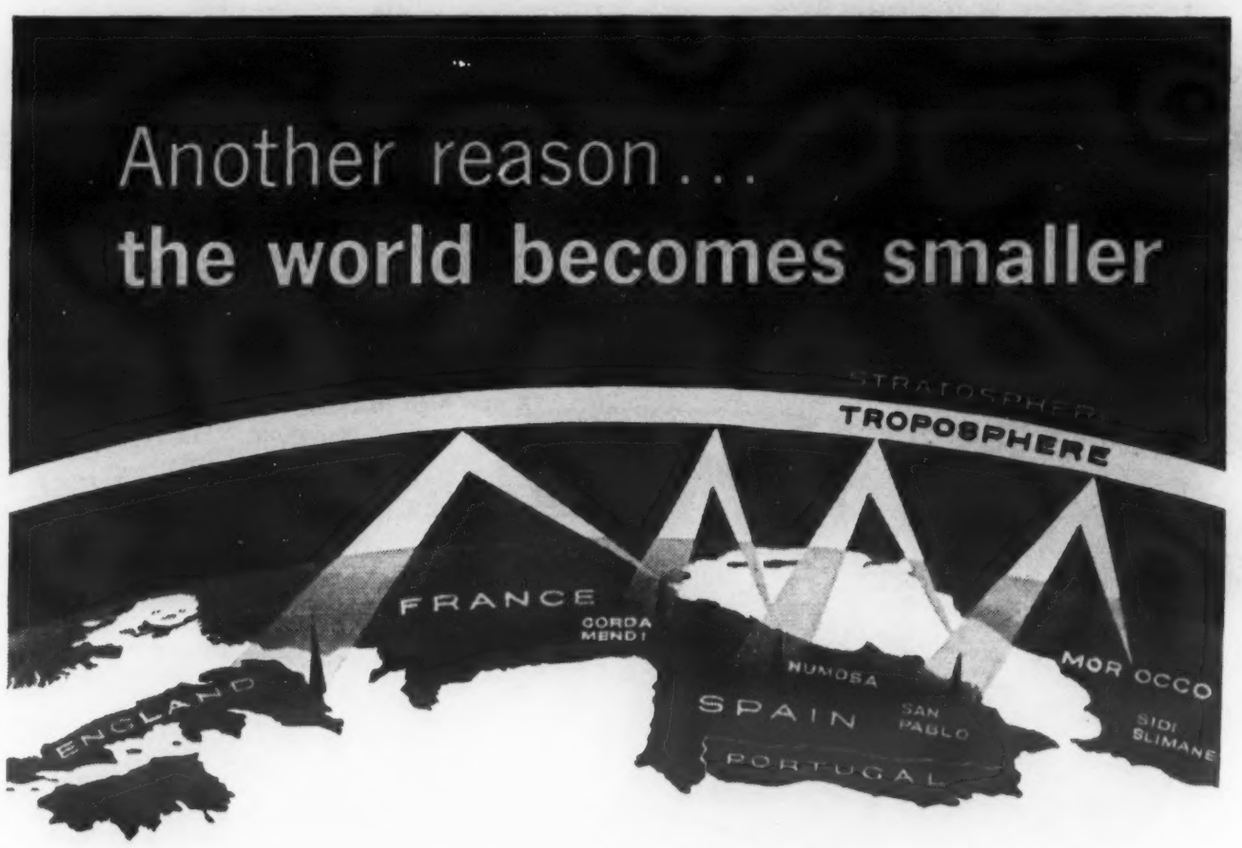

Troposcatter network, providing multi-channel Telephone, Teleprinter, and Data Transmission, linking England, Spain and North Africa is being designed and built for the Air Force
by

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ALDEN SCANNERS MARK NEW ERA IN FACSIMILE COMMUNICATIONS

Compact, mobile Alden Flat Copy Scanners are in use today throughout the U. S. Weather Bureau Hi-Altitude Facsimile Network — marking a bright new era of simplified, continuous facsimile communication. And here are the reasons why —

NEW INSTALLATION SIMPLICITY . . . within two hours of air delivery, Alden Scanners at the Hi-Altitude Network were uncrated from their fold-away shipping cases, rolled in, plugged in, and *fully tested* for 60, 90, and 120 RPM quiet and dependable operation.

NEW COPY HANDLING SIMPLICITY . . . map transmission is no longer dependent on exact drum mounting. With Alden's expandable copy feed head, maps of *any width or length* can be scanned, one after the other, fed straight or crooked, *with only one Alden Scanner.* Original plotted maps can now be scanned without cutting to size. Map plotters have originals returned in half the time. Space and maintenance problems are minimized.

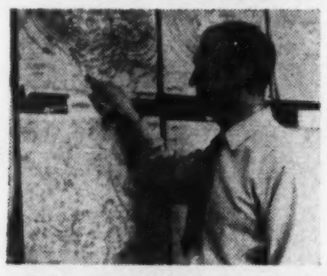
NEW CLARITY — NEW SHARPNESS . . . with copy feed rolls precisely positioning surface of the map on the flat copy scanner table, exact focal lengths are maintained for clear, sharp recordings. Focus smudge caused by unusually thick copy or copy lifting from drum is *completely eliminated.*

MEETS ALL FUTURE REQUIREMENTS . . . the practical scanning equipment for a world-wide facsimile map network. Speeds can be easily increased — without reengineering of equipment — for use with coaxial or microwave transmission facilities and computer-processed weather data.

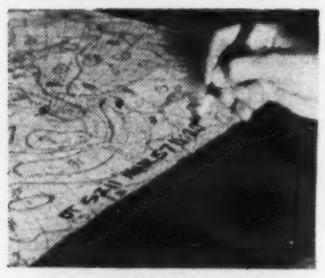
WHAT ARE YOUR FACSIMILE REQUIREMENTS? LET'S GET TOGETHER . . . Alden Flat Copy Scanners and Recorders are available in all sizes (and up to 30 times present network speed) to users and qualified manufacturers. Your inquiry is invited.

HERE'S WHY FORECASTERS PREFER* ALDEN RECORDERS AND ALFAX MAPS AND WHY WE THINK YOU'LL LIKE THEM TOO!

MOST COMMENDED FEATURES OF ALFAX MAPS



Color Is Easiest To Read Under All Lighting Conditions



Ease Of Writing And Erasing Enhances Analysis

Clean Crisp Duplicates By Bruning Or Ozalid

PLUS THESE UNIQUE FEATURES

LOW COST . . . Alfax papers save ⅓ to ⅔ yearly paper costs.

CLEAN . . . Electricity is the Ink . . . ion deposits make crisp brown marks on clean white background — free from dust, smudge and chemical irritants.

PERMANENCE . . . Alfax stores indefinitely . . . recording marks are permanent.

*In surveys of weather forecasters experienced with all weather facsimile systems, 3 out of 4 indicated a marked preference for Alden Recorders and Alfax Maps.

MOST COMMENDED FEATURES OF ALDEN RECORDERS

EASE OF INSTALLATION
Compact, mobile, and ready for immediate operation.

Uncrate

Roll in

EASE OF OPERATION
A new high in clean, quiet, trouble-free operation

Instant Visibility

Easy Paper Loading

Automatic Time-Clock Programming

EASE OF MAINTENANCE

Front panel checks

Back connector checks

Plug-in construction

PLUS THESE UNIQUE FEATURES

SECURITY . . . Low voltage marking process does not generate a signal that can be intercepted.

HIGH SPEEDS . . . Sixty, 90 or 120 RPM operation — recorder technique and paper capable of 15 times these existing speeds.

VOLUME PRODUCTION . . . Designed for volume production on short lead time through unique expandable manufacturing processes.

CEILOMETER BREAKTHROUGH

Used with rotating beam ceilometer, Alfax paper and Alden recording techniques replace continuous live scope observation with a continuous pictorial history of cloud conditions. Dynamic tone-shade gradients in warm color reveal all pertinent ceiling information in easy-to-read, easy-to-interpret form. Superimposed dark maximum signal marking shows exact reportable cloud height.

ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO., INC.
Alden Research Center
Westboro, Mass.

the second long period of decreased activity to dog Operation Deep Freeze 61. October snowstorms caused a ten day delay soon after the summer operating season began.

Of the delay, Rear Admiral David M. Tyree, Commander of Deep Freeze, said, "Although the storms have caused us to make changes in our original schedules, we have been able to readjust, utilizing our new Navy Hercules aircraft for delivering cargo to Byrd and Pole stations. The Air Force Globemasters are then released to bring cargo from Christchurch to Antarctica by air. We have every confidence that Deep Freeze 61 will finish up on schedule with the mission accomplished."

• • •

Educating American youth in an "ideology of Freedom" will be the topic of a conference sponsored by the Institute for American Strategy in Chicago, April 10, 11 and 12.

Ways and means of instructing youth in the dangers of communism while fostering an appreciation of the American way of life will be discussed. The occasion will be the 7th annual National Military, Industrial and Educational Conference. About 2000 leaders from fields of industry, education, government, business and military are expected to attend.

The 3-day conference, *Education and Freedom in a World of Conflict*, will be held at the Sherman Hotel.

• • •

A new lightweight nuclear generator which converts heat directly into electrical power is undergoing performance testing at the Air Research and Development Command's Air Force Special Weapons Center in Albuquerque, New Mexico.

The completely portable nuclear auxiliary power device, which weighs considerably less than 40 pounds, was designed and constructed by the Westinghouse New Products Laboratory in Pittsburgh.

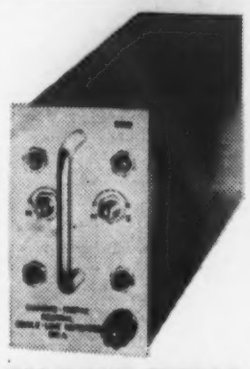
The generator produces approximately 150 watts of electrical power and was designed for one year of continuous unattended operation. It is designed to use radioactive isotopes, such as Curium 242 as its heat source. The generator's 144 small semiconductive elements are heated by the heat source to a temperature of about 1,000 degrees F. Finned heat exchangers, which cover the generator, keep the ends of the elements farthest from the heat

(*Continued on page* 75)

TREPAC

Solid State Electronics for TELECOMMUNICATIONS

New TRANSISTORIZED TELEPRINTER REPEATERS



DIAMOND-TREPAC

For High Speed Data & Teletype Transmission

Incorporating Solid State Relay 530C, these new repeaters offer greatly simplified, maintenance-free, operation over lines with heavy AC interference, high leakage and large amounts of characteristic distortion. Units are non-critical as to location in telegraph loop. Repeated signal is clear and consistent. Five complete units mount in standard 19" relay rack.

OPERATES ON SELF POWER DURING POWER FAILURES

MODEL 530-C

TELEPRINTER RELAY

Featuring built-in reliability and ruggedness, these units have long maintenance-free life. Proved by over three years use in field by major communications companies. Will operate both old and new type teletypewriters and eliminates line relays, spark suppressors and rectifiers. Easily mounts within teleprinter housing.

Creates no radio frequency interference

AUTOMATIC TELEPRINTER MOTOR CONTROL

Provides automatic control, of the sending and receiving teleprinter drive motors. Reduces wear and maintenance on motor and clutch mechanical assemblies—generates no heat - 90% saving in size and weight. Easily mounts in teleprinter without modification. No special starting or stopping signals required. Operates from 20 to 60 mil neutral or polar signal.

MODEL 550

TREPAC CORPORATION OF AMERICA
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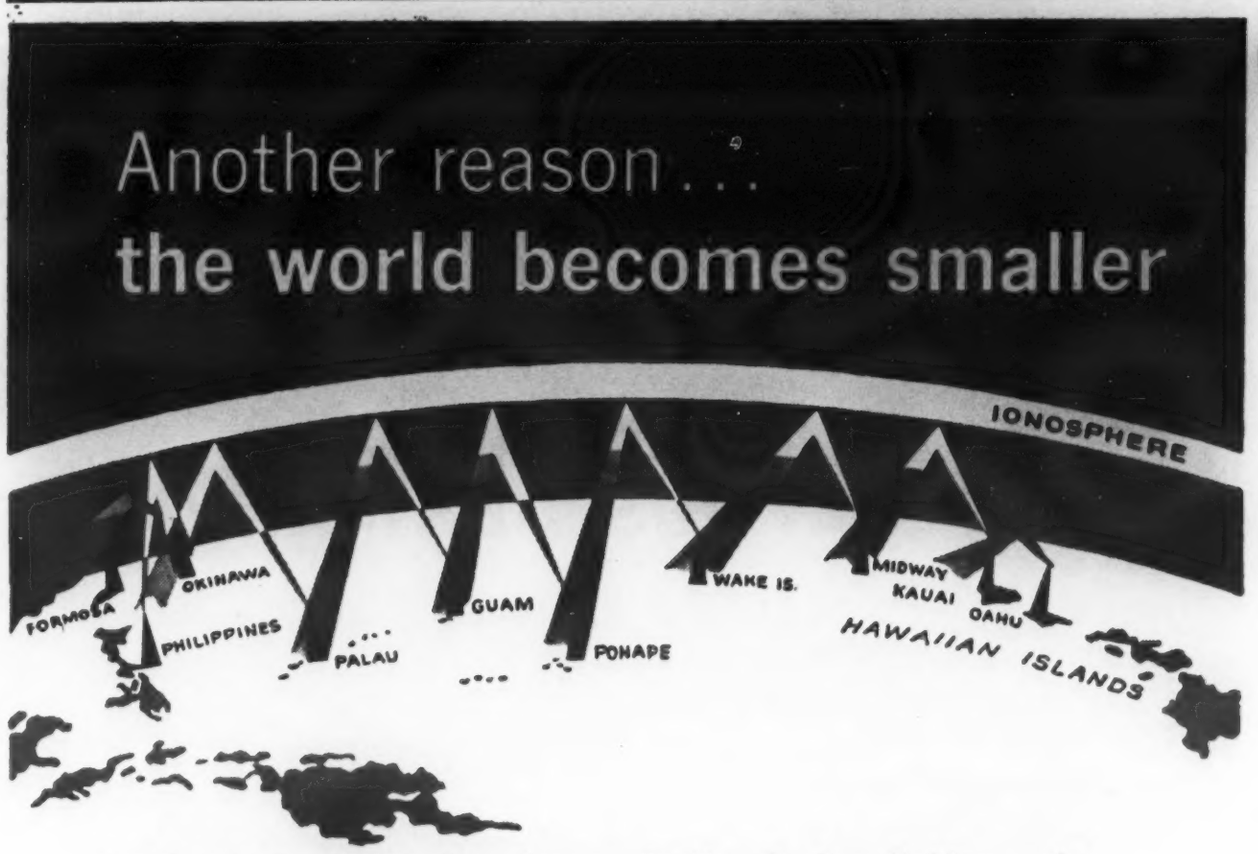
TREPAC



7,500-mile Pacific Scatter Communication System linking major command posts from Hawaii to Formosa was recently designed and built for the U. S. Army Signal Corps

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The *Videotape** Television Recorder has been saving valuable time in Armed Forces installations since 1957. A typical example: watching a taped closed-circuit telecast for three hours a day enabled a class in fundamental electronics to be graduated four weeks early.

Ampex VTR brings to military training these specific benefits: universal availability of top-level instruction (the best teachers can perfect their techniques before presentation) . . . increased trainee attention and concentration . . . close-up examination of elements by the whole class simultaneously . . . remote demonstration of dangerous phenomena. And VTR's inherent capabilities permit flexibility in editing plus maximum security since the tape can be immediately erased and requires no outside servicing.

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News Items

(*Continued from page 73*)

source at a temperature of 300 degrees F. This temperature difference produces a flow of electrical current in the elements.

The generator, designated the NAP-100, is only 10 inches high, with a diameter of 16 inches. It produces more power per pound of generator weight than any similar device.

• • •

Bell Telephone Laboratories have announced the development of a continuously operating optical maser. The device uses a mixture of helium and neon gases for its active medium. It receives its energy from a low-powered (tens of watts) electrical discharge within the gas, and has an output power of about 1/100th watt.

Lying in the infrared portion of the frequency spectrum, the beam of coherent radiation is highly directional, having a spread less than one minute of arc. A gaseous optical maser on earth, operating through a suitable telescope, could send a beam to the moon that would cover a spot smaller than one mile in diameter.

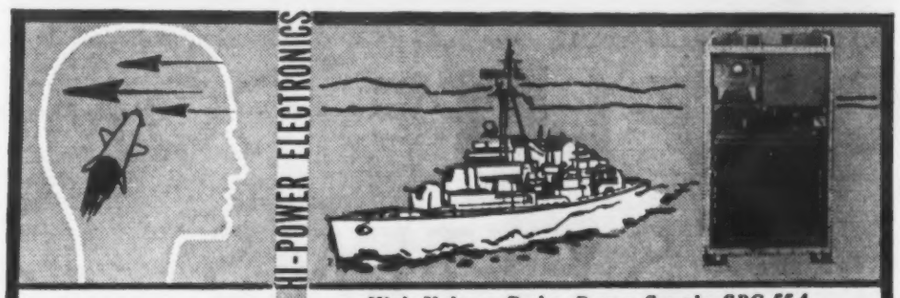
Bell Laboratories scientists have been experimenting with several methods of modulating a signal on an optical carrier. As an initial experiment. they impressed a telephone conversation on a maser signal on December 14. 1960, by using an electro-optical device—the Kerr Cell. Broadband modulation has been accomplished at frequencies up to 60 kc. Other modulation schemes may result in systems operating as high as several thousand mc.

The path of the optical carrier will be a straight line, except where it is reflected. Thus one application of the optical maser would be to transmit information to and between orbiting satellites. On earth, the beam could be contained in some enclosure, such as a long pipe. This pipe could wind around the countryside carrying signals with very little loss, if turns were made at angles containing reflecting mirrors.

• • •

Radio Corporation of America has developed a double transistor. The device, incorporating planar design and construction principles and dubbed the Siamese Twin, is capable of boosting ten-fold the voltage of a standard automobile battery in increasing other low-power sources in varying degrees, RCA reports.

(*Continued on page 77*)



High Voltage Radar Power Supply SPG-55A

Powerful tools for high power knowledge

FXR's broad experience in the design and fabrication of high voltage power supplies, super-power pulse modulators and custom solutions to unique challenges is the result of extensive knowledge and creative application.

A significant achievement is the High Voltage Radar Power Supply, AN/SPG-55A. The environmental conditions imposed by shipboard installation offered a most complex challenge. The problem of reliability was solved in a unique manner typical of FXR's High Power Electronics capabilities.

The solution to your problem is but a telephone call away. Our applications engineers will be glad to discuss your requirements.

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Design • Development • Manufacture

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A new Voice of America broadcasting facility in Liberia is being engineered by Page. Three previous VOA stations in Tangier, Okinawa, and the Philippines, bringing together over 100 nations, were designed and built by

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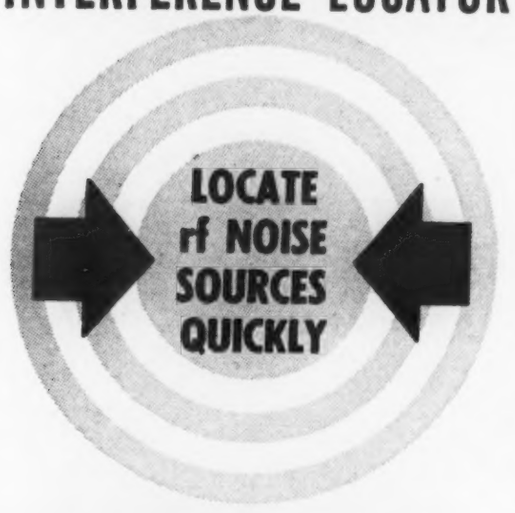
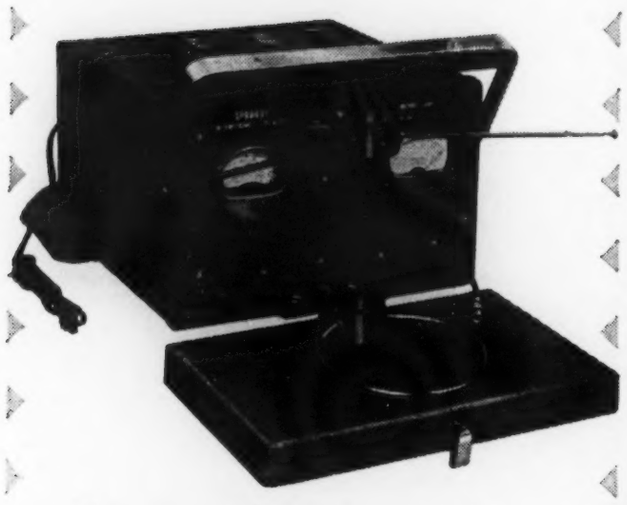
MODEL 500
INTERFERENCE LOCATOR





This versatile instrument is a highly sensitive interference locator—*with the widest frequency range of any standard available unit!* Model 500 tunes across the entire standard and FM broadcast, shortwave, and VHF-TV spectrums from 550 kc. to 220 mc. in 6 bands.

It's a compact, portable, rugged, versatile instrument—engineered and designed for most efficient operation *in practical field use*. It features a transistorized power supply, meter indications proportional to carrier strength as well as sensitivity of 5 microvolts minimum for 5% meter deflection over entire tuning range.

For full details, send for brochure IL-106.

SPRAGUE ELECTRIC COMPANY
287 Marshall Street, North Adams, Mass.

SPRAGUE®
THE MARK OF RELIABILITY

The double transistor will be offered initially as a dc chopper amplifier. The device can be made to amplify electronic signals, convert them from dc to ac current and back again, regulate their power or flow, subtract one signal from another and amplify the difference.

• • •

Texas Instruments Incorporated and International Telephone and Telegraph Corporation have announced an agreement to exchange non-exclusive patent licenses and technical information concerning semiconductor components. Texas Instruments will also supply a portion of ITT's needs for semiconductor devices and components.

• • •

Electronic Laboratories Corporation, Torrance, California, has developed a single sideband crystal filter using fourteen piezoelectric crystals. The new ELC crystal filter development features sharp selectivity on both sides of the band pass characteristic and one unit may be used in

(*Continued on page* 80)

How to CONTROL and ALARM the TOWER LIGHTS of UNATTENDED Microwave and Communication Stations

PHOTO ELECTRIC PANEL
Automatically turns Tower Lights ON and OFF in accordance with FCC regulations
FLASHER PANEL - Automatically Flashes Beacon Lamps – with balanced load provisions.
ALARM PANEL - Automatically provides signals indicating failure of any lamp, power or control.

Model LC 201
TOWER LIGHTING CONTROL UNIT
(for Two Light Levels)
Model LC 101 (for Single Light Level)
Model LC 301 (for Three Light Levels)
Models also available with separate Alarm Signal for each Beacon Lamp.

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Another reason . . .
the world becomes smaller

Turkey trot . . . tropospheric scatter network employing fixed and mobile stations . . . linking eight strategic areas through Turkey with more than 99% reliability . . . is being designed and built for the U. S. Air Force

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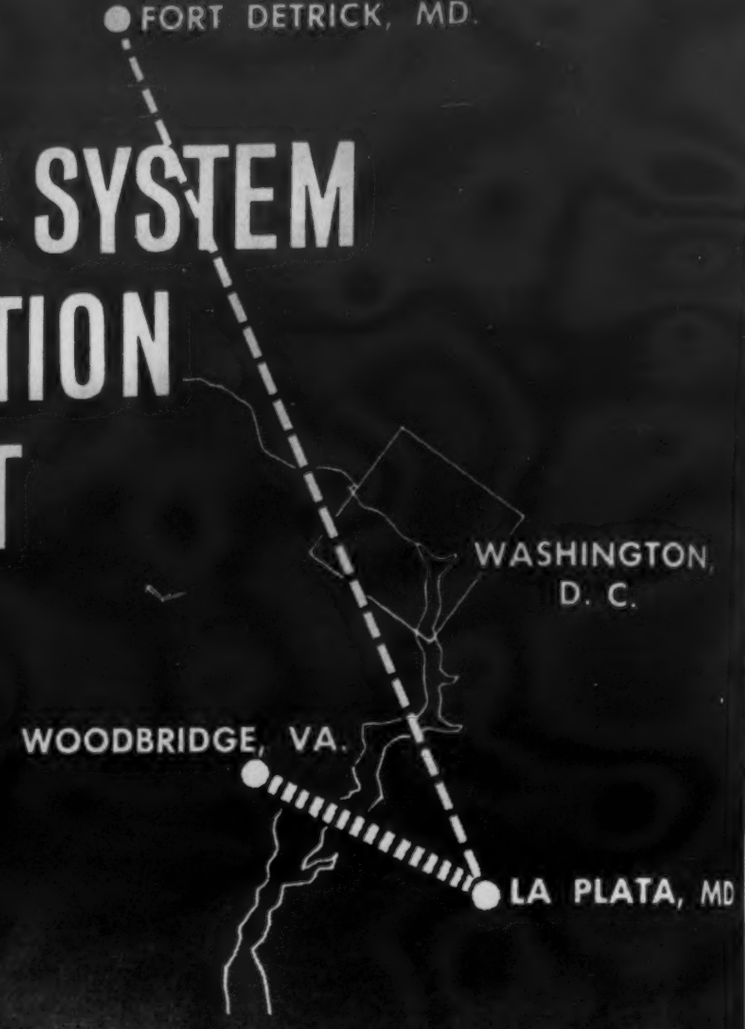
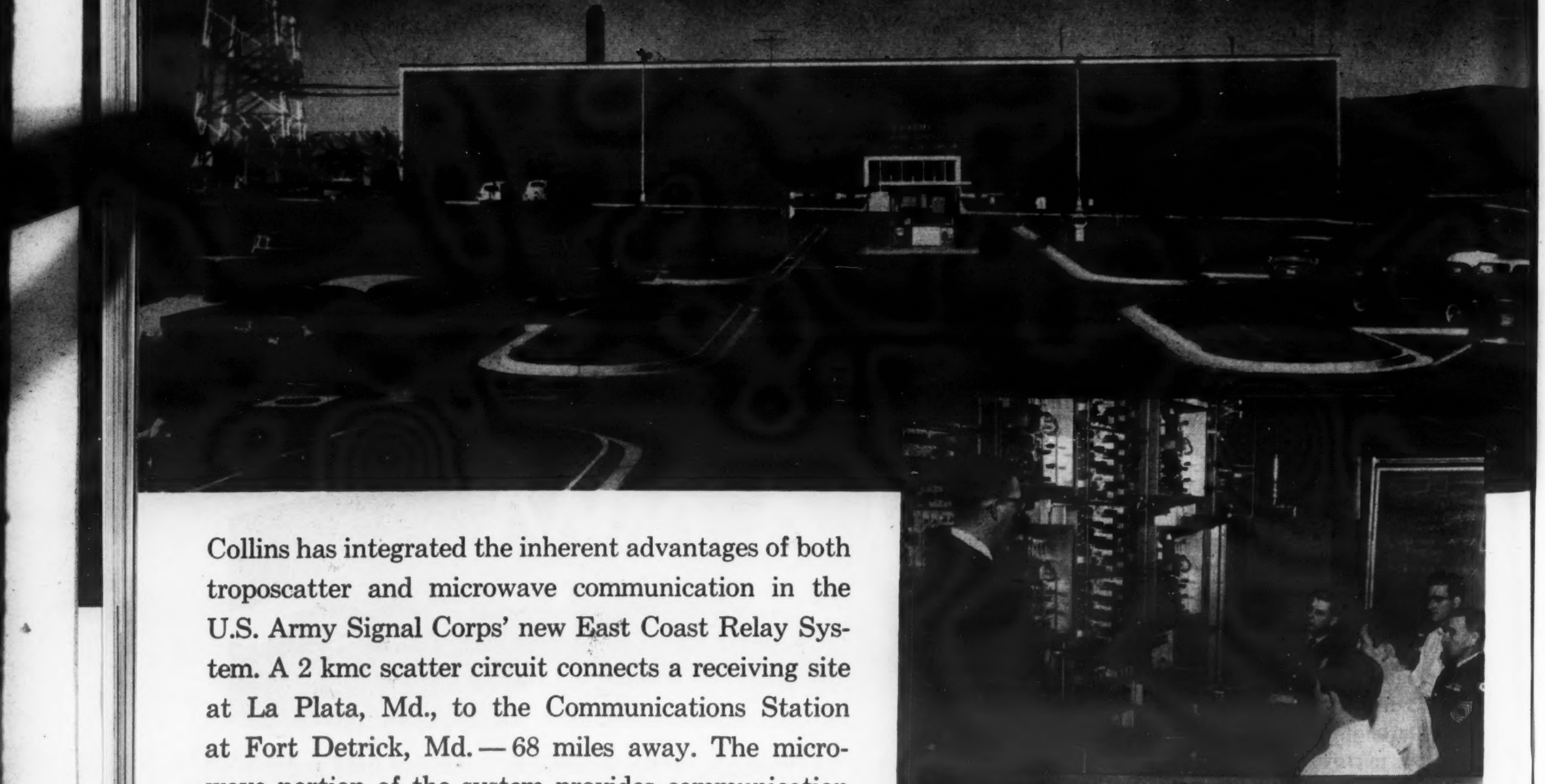
COLLINS SCATTER-MICROWAVE SYSTEM LINKS EAST COAST RELAY STATION AND ARMY'S WORLD-WIDE NET





Collins has integrated the inherent advantages of both troposcatter and microwave communication in the U.S. Army Signal Corps' new East Coast Relay System. A 2 kmc scatter circuit connects a receiving site at La Plata, Md., to the Communications Station at Fort Detrick, Md. — 68 miles away. The microwave portion of the system provides communication between the transmitter site at Woodbridge, Va., and the receiver site at La Plata — a distance of 16.8 miles. Collins Carrier provides 120 channels on both the microwave and scatter circuits. All incoming and outgoing national defense messages handled by the Army Signal Corps in the Washington, D. C., area will be processed through the new station.

COLLINS

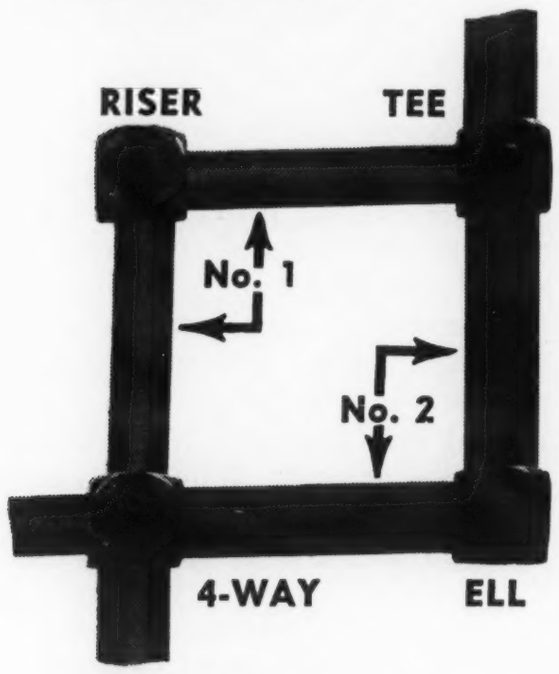
COLLINS RADIO COMPANY • DALLAS, TEXAS • CEDAR RAPIDS, IOWA • BURBANK, CALIFORNIA

FLEXIDUCT

Part No. 345 *Patent Pending

NEW, universal fitting* used with the two sizes of Flexiduct solves all over-the-floor wiring problems.

USE AS A....



- **Under Floor Input**
- **Terminal Box**
- **Junction Box**
- **Or In Combinations of All**

Fits any over-the-floor wire molding. This new fitting used with Flexiducts two sizes is the popular, easy solution on all jobs.

Flexiduct No. 1 FSN 5975-235-5208
will carry up to 8 conductors of inside wire. Chase ¼"x½"

Flexiduct No. 2 FSN 5975-235-5209
will carry up to 25 pair cloth cable or 16 pair plastic. Chase ½"x¾"

Always keep Flexiduct on hand.

For descriptive literature, prices, write

WINDERS & GEIST, INC.
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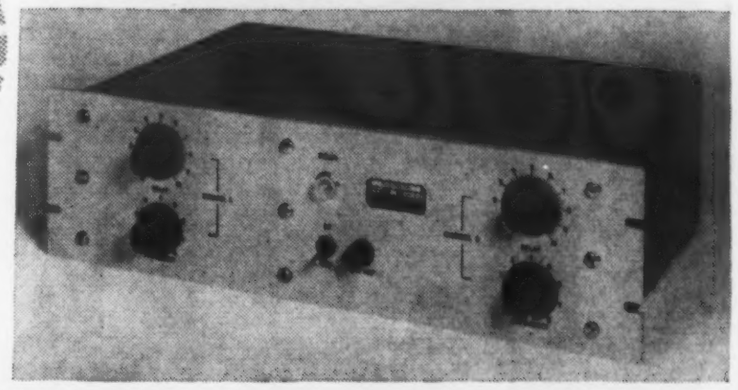
RIXON'S DELAY EQUALIZERS . . .
FOR BETTER COMMUNICATIONS

IMPORTANT



Data transmission, affected by "delay distortion" on wireline and other narrow-band media is corrected by RIXON'S EN 766 series of continuously variable DELAY EQUALIZERS. Compensation of delay distortion is accomplished by passing phase distorted signals through all-pass networks having delay versus frequency characteristics complementary to the communications path. To insure rapid delay compensation by simple adjustment, these characteristics can be adjusted to shift the frequency of maximum delay and continuously vary the amount of delay until an oscilloscope presentation of the recovered signal agrees with its configuration prior to transmission.

FOR PRECISE SPECIFICATIONS ON THE ABOVE EQUIPMENT, WRITE FOR OUR ENGINEERING BULLETINS. SEE OUR BOOTHS 3064 & 3065 AT THE MARCH I.R.E. SHOW

DEVELOPMENT ENGINEERING A wide variety of transistor and other circuit design applications for data processing equipment, instrumentation, high speed switching and power supplies.
SUBCONTRACT PRODUCTION Electronic assemblies ranging from miniature modules to high power transmitters. Complete model shop, assembly, potting and core winding facilities available. High quality control standards.

RIXON
ELECTRONICS, INC.

2414 Reedie Drive — Silver Spring, Maryland LOckwood 5-4578

An experimental satellite communication relay being designed and engineered under cognizance of Rome Air Development Center will transmit voice and teletype 2000 miles through space via a passive orbiting satellite. Stations will be at Floyd, N.Y. and Trinidad.

Page COMMUNICATIONS ENGINEERS, INC.

Subsidiary of Northrop Corporation

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FABMDS

...One of many projects in Systems Engineering at General Electric's Special Programs Section

FIELD ARMY BALLISTIC MISSILE DEFENSE SYSTEM

Modern battle concepts of the United States Army require new tactical and support systems. Because of their increasingly complex nature, extensive capabilities in systems management and systems engineering have assumed greater importance.

It was for this reason that General Electric's Special Programs Section was established. Typical of its current projects is a study program for a Field Army Ballistic Missile Defense System. This system involves the integration of sensor components, communications links, data processing units, guidance, the vehicle aerodynamics, structures, stability and control, together with its launching and support equipment – all within a compatible systems structure.

To accomplish its objectives, SPS is staffed with a select group of senior engineers who act as a technical team to make systems recommendations... plan and create systems configurations and detailed specifications... establish implementation schedules... conduct continuing evaluation studies... direct and coordinate sub-contractor efforts – both within General Electric and outside the company.

Each engineer at SPS is highly competent within a broad field of technology, and has a working knowledge of several allied disciplines. He may concentrate on different aspects of a variety of problems, or follow a project, such as FABMDS, through to its completion.

Qualified engineers and scientists who want to apply a systems perspective to highly advanced problems are invited to contact us about a number of current openings. An advanced degree is desirable, with 3-10 years of experience in one or more of the following areas:

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ARMAMENT
COMMUNICATIONS
APPLIED PHYSICS
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SYSTEMS RELIABILITY
SYSTEMS COST ANALYSIS
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AIRFRAME ANALYSIS
MICROMETEROLOGY
RADIATION EFFECTS
WEAPONS SYSTEMS ANALYSIS
VEHICLE PRELIMINARY DESIGN
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Write in strict confidence to Mr. R. W. Hildick, Dept. 142-MO

SPECIAL PROGRAMS SECTION | GENERAL ELECTRIC

Radnor-Chester Road • Radnor, Pennsylvania

DEFENSE SYSTEMS DEPARTMENT of the Defense Electronics Division

News Items

(*Continued from page* 77)

the same chassis for alternate transmission and reception.

The SBU-175B fourteen-crystal filter has a passband from 300 cps to 3.2 kc at a carrier frequency of 1.75 mc, lower sideband and carrier frequency rejection of 70 db with insertion loss of 5 db and passband ripple of ±0.5 db, operating temperature range from —55°C to +85°C. The filter is housed in a 1" × 2.625" × 4.187" case with subminiature coaxial connectors.

• • •

International Business Machines Corporation reports the development of a magnetic core memory for computers which contains built-in "shortcuts" to stored information.

The experimental memory represents an advance in an approach to a relatively new concept called *associative memory*. The prototype unit was constructed with existing components to show the feasibility of a ferrite magnetic core associative memory that can operate at speeds equivalent to today's memories.

The shortcuts provided in such a memory may speed up access to stored information by eliminating the need for a considerable amount of programming in certain kinds of processing. Although the experimental unit disclosed by IBM has a capacity of only four information bits, IBM has carried out studies indicating that a large-scale associative memory, comparable in speed and capacity to conventional units now available, is technically feasible.

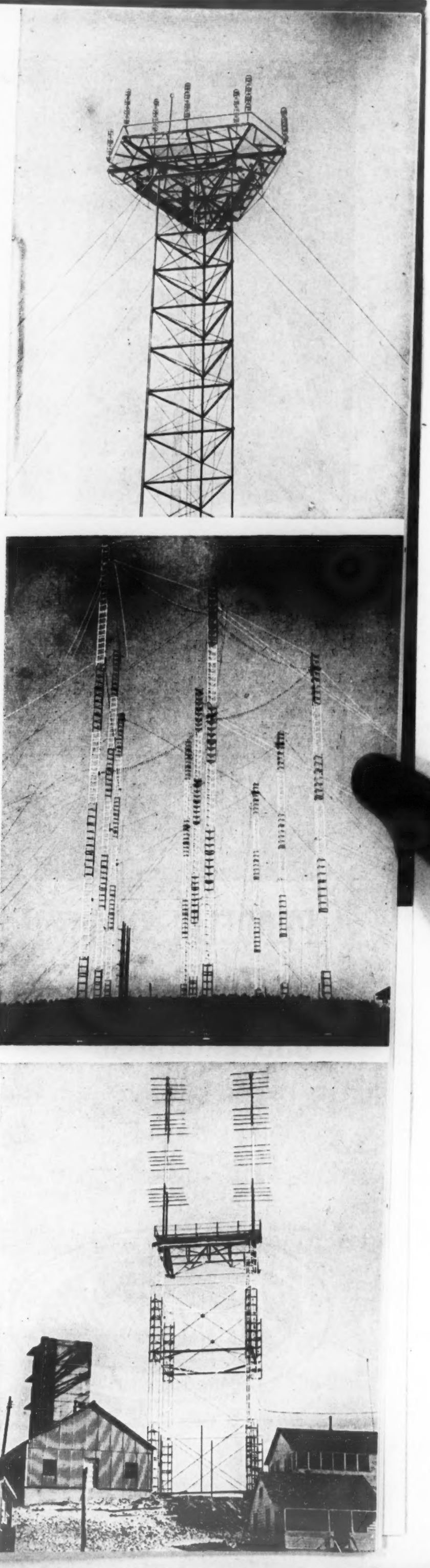
The magnetic associative memory was reported in the IBM Journal of Research and Development for January by H. E. Persen and W. L. McDermid.

• • •

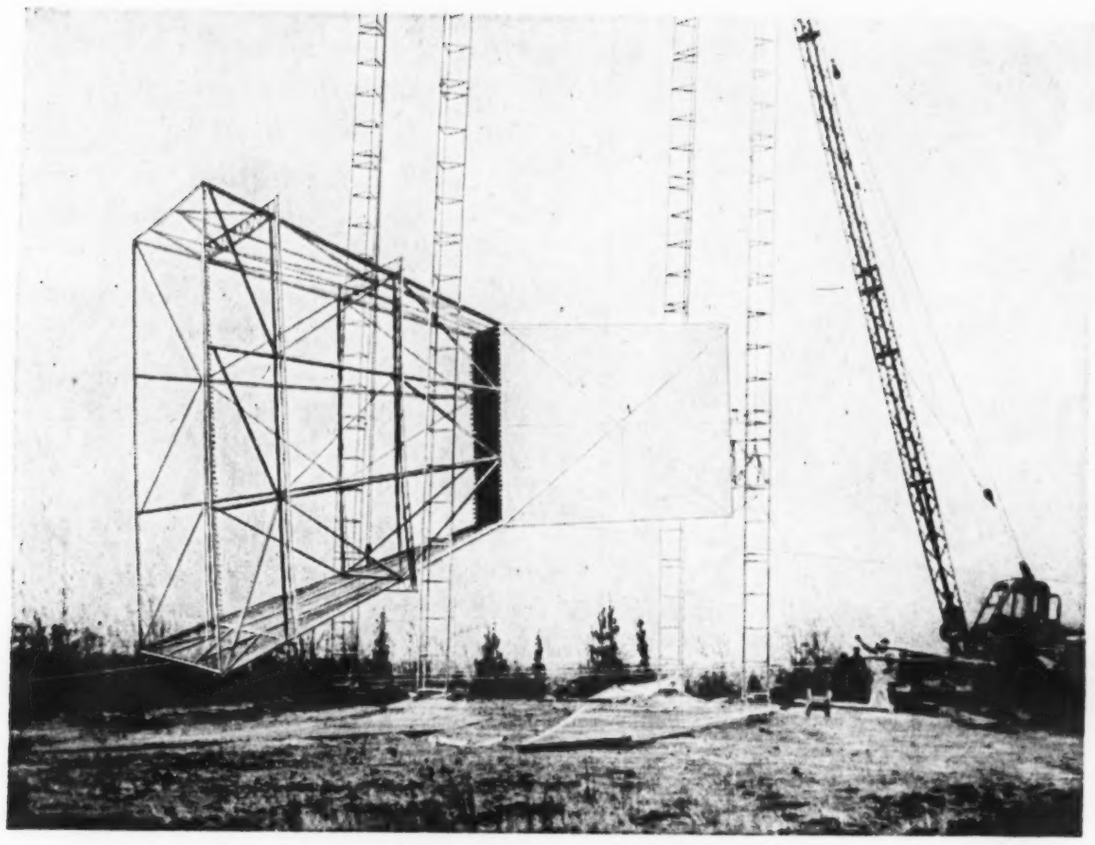
A new U. S. Army Nike-Zeus digital computer, the first computer ever built from complete information furnished by another computer, has been shipped to Ascension Island in the South Atlantic. The computer, built by Western Electric, was developed by Bell Telephone Laboratories in Whippany, N. J., for special tracking tests of incoming ballistic missiles launched from Cape Canaveral. Used with the Nike-Zeus target track radar, the computer will collect and process data concerning the radar characteristics of incoming missiles.

The new computer was designed with a general purpose scientific

(*Continued on page* 82)



Special-design tower supporting Air Force antennas for test purposes.



Horn-type receiving antenna and support towers for signal amplification.

Towers supporting large curtain type antenna for scatter communication.

STAINLESS TOWER DESIGNS OFFER UNUSUAL VERSATILITY FOR SPECIAL APPLICATIONS

"Custom" design utilizing Stainless stock tower sections is the answer to many special tower requirements. Standard stock tower sections may be modified and adapted to special specifications at minimum cost.

A wide variety of self-supporting or guyed structures are available to support all types of top or antenna loads and withstand all types of wind, ice and rigidity conditions.

Let Stainless' Design Staff advise and assist you with your structural problems.

Special design self-supporting test structure having very rigid deflection and ice load specification.

STAINLESS, INC. • NORTH WALES • PENNSYLVANIA

PRODELIN Selected for The Great USS Enterprise

■ The USS Enterprise is a mighty ship with important work to do. Supremely important in the communication complex aboard this vast nuclear-powered aircraft carrier are reliable transmission line systems. Prodelin semi-flexible aluminum Spir-O-line and copper Rigid '800' are now performing in this service.

Spir-O-line semi-flexible coaxial cable, with Spir-O-lok, its companion connector, are a proven combination designed to provide performance unequaled in the transmission line art.

Rigid '800' coaxial transmission lines in copper or aluminum continue to lead the field utilizing reactance compensated pin-type insulators, another proven Prodelin development in rigid, air dielectric coaxial line. Let Prodelin experience give your project reliability and high performance for the most demanding requirements.

MANUFACTURERS OF THE WORLD'S FINEST ANTENNAS AND TRANSMISSION LINES
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Catalogs available upon request.

598 - 2-Way Mobile Antennas
603 - Microwave Parabolic Antennas and Accessories
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Call WYman 1-8600 or write: Prodelin, Inc., 307 Bergen Avenue, Kearny, N. J., U.S.A.

computer utilizing an automatic process called BLADES, a system devised by Bell Laboratories. BLADES is an acronym for *B*ell *L*aboratories *A*utomatic *DE*sign *S*ystem.

The BLADE System converts basic design data, originated by Bell Laboratories engineers, into manufacturing information which can in turn control automatic machinery for producing subassemblies of data-processing equipment.

• • •

Mycalex Corporation of America has developed an electronic insulation designated Supramica(R) 620 "BB" ceramoplastic. The company reports that Supramica will operate at 1200° F and provides a hermetic seal so tight that high precision testing equipment can detect no leakage, even of helium.

Supramica expands and contracts under temperature changes at the same rate as many metals including titanium. Some of the advantages of the development are listed by Mycalex as: High dielectric strength—270 volts/mil.; Excellent arc resistance—300 seconds; Negligible electrical loss—.020 loss factor at 1 megacycle; and, High electrical resistance—1 x 10^8 ohms-cm. at 932° F.

• • •

A new 200 ampere dynamic test set, Model 164, to simultaneously evaluate the characteristics of four silicon rectifiers in a full wave circuit, has been developed by Wallson Associates, Inc.

The basic circuitry consists of two power supplies—a low voltage, high current supply for forward characteristics; and a high voltage, low current supply for reverse characteristics. Simulation of actual operating conditions is achieved by electronically switching these power supplies on alternate half cycles. Parameters are adjusted independently of each other.

Test capacity of the Model 164 is four rectifiers in the range of 5-200 amp DC average forward current. Peak reverse voltage is adjustable between 0-1500V; any combination of forward current and reverse voltage within these ranges may be obtained.

• • •

Technical Operations, Incorporated, Burlington, Massachusetts, has published a ten-page brochure on war gaming and military operations research.

Called *Trends in Military Operations Research,* the booklet covers the development of a soldier-scien-

(*Continued on page* 84)

THIS TROUBLE HAS NO FUTURE!

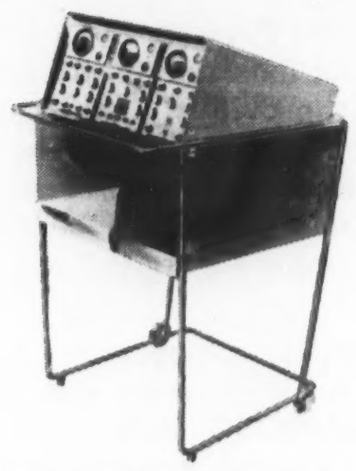
Radiation's TDMS anticipates circuit failure in telegraph and data transmission links without interrupting traffic

Radiation's Telegraph Distortion Monitoring System—TDMS—is a compact, self-contained unit for continuous on-line monitoring, testing and analysis of telegraph and data transmission links.

Its sensitivity to signal distortion is so acute that it can locate and describe equipment misalignment *before* it becomes an operational problem.

TDMS does its job without interrupting traffic and in a language that is easily interpreted by a nontechnical operator. Thus, in our illustration above, a line that is becoming increasingly capacitative can be located and rectified prior to circuit failure.

For detailed information on the TDMS, write Dept. S-3, Products Division, Radiation Inc., Melbourne, Florida. Refer to Bulletin RAD-E-100B.



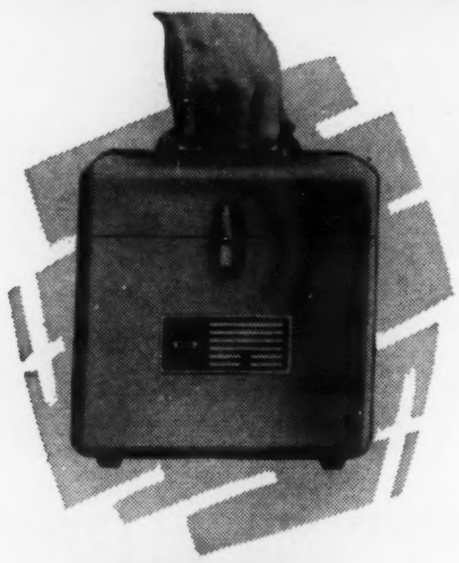
TDMS performs all of these *on-line* functions: 1. Distortion transmitter; 2. Test message transmitter; 3 Distortion analyzer; and 4. Linear wave-form analyzer.

Among available accessories are utility cart (shown above), portable power supply, and relay-test adapter.

RADIATION INCORPORATED

The NEW BH190 MULTI-RANGE

D.C. digital VOLTMETER



for checking systems and components in

GROUND SUPPORT
FLIGHT DECK
TELEMETRY
TEST CELLS

PORTABLE • ***ACCURACY 0.1%***

The BH190 *Portable* D.C. Voltmeter is a *digital* indicating instrument with accuracy previously available only in laboratory equipment. The unit is a continuous null balance slide-wire potentiometer with a simple and direct analog-to-digital conversion system.

It is completely self-contained...including power supply, servo unit, slidewire and amplifier. *Weighs less than 10 lbs.*

Transistorized, it requires no warm-up time! Operates from 115 volts, 60 or 400 cycles, 20 VA. as specified.

CALIBRATION—The instrument is available with a maximum of four ranges. Ranges increase by a factor of 10. The minimum range is zero to .020 v.d.c.; maximum range is zero to 10,000 v.d.c. *For example:* 0—.0500;
0—.5000; 0—5.000; 0—50.00.

Produced by the makers of JETCAL® jet engine Analyzer...*in worldwide* military and airline use.

Full information is available for the asking!

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TORONTO, ONT. *(George Kelk Ltd.)* MITCHAM, SURREY, ENGLAND *(Bryans Aeroquipment Ltd.)*

tist relationship in operations research, the urgent need for data, and war gaming as a partial substitute for field experience. It also points out the increasing need for the synthesis of accumulated knowledge of military operations research.

• • •

The Military Relations Department of the Electronic Industries Association is preparing a guide book to assist contractors in settling contract terminations. The guide is expected to be particularly useful to small companies which do not have experienced terminations experts on their staffs. Edwin P. James of Collins Radio Company is chairman of the department's Terminations Committee which is sponsoring the project.

Additional information may be obtained by writing to Electronic Industries Association, 1721 DeSales Street, N. W., Washington 6, D. C.

• • •

The John E. Fast & Company, 3580 North Elston Avenue, Chicago 18, Illinois, a subsidiary of the Victoreen Instrument Company, has published a manual called *Capacitor Engineering Data Useful in Designing High Reliability Circuits.* The manual records the story of a 30-year search for capacitor reliability and is illustrated with distribution curves of data on breakdown studies.

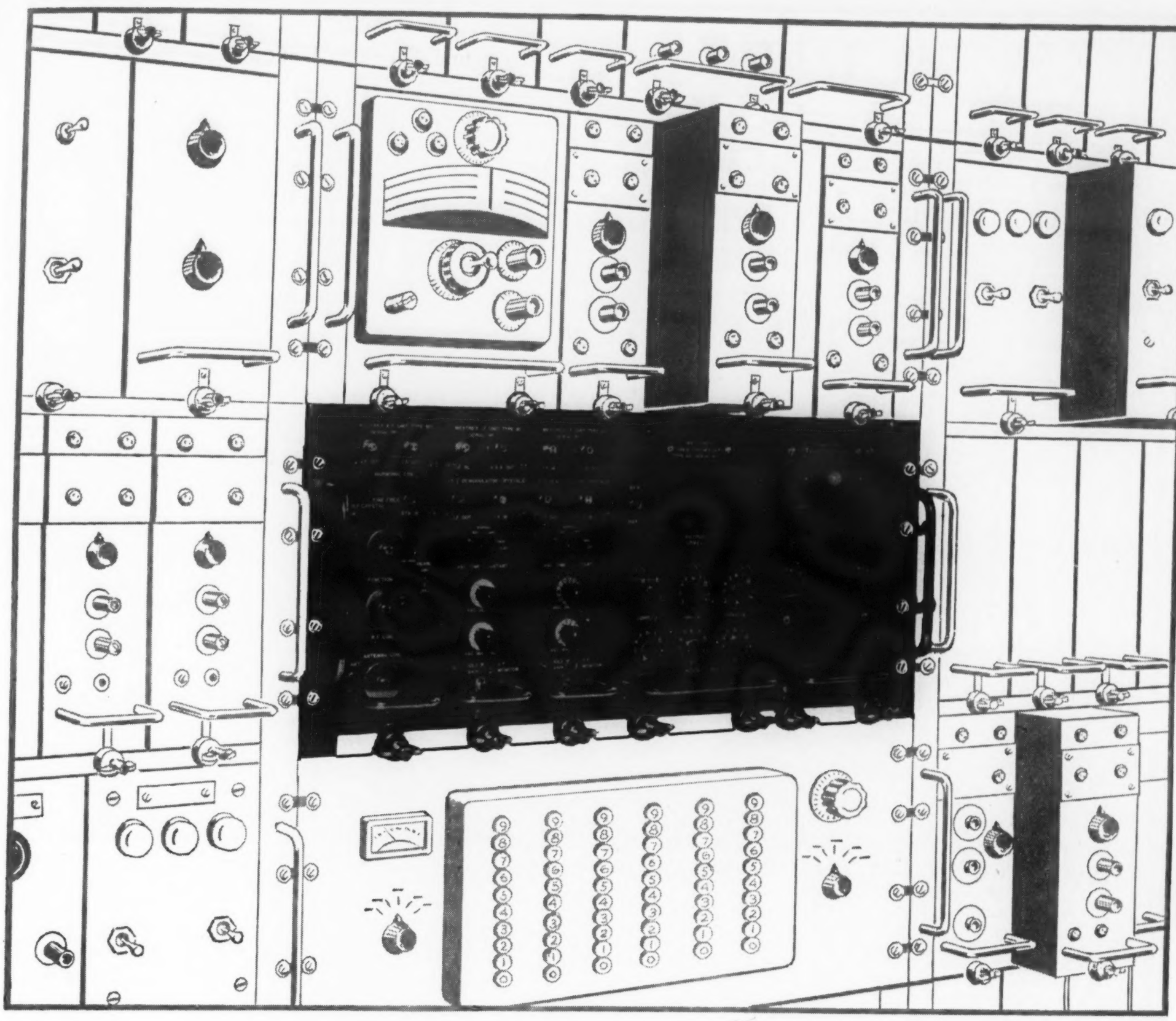
The publication examines such parameters as voltage, temperature, frequency, insulating materials and area of windings. The manual discloses how life, capacitance and leakage current are affected over extended temperature ranges. Dissipation factor comparisons dating from the time of linen paper to today's Teflon film dielectrics are presented.

Photoprogress

A 4500 pound, 36 inch aperture telescope system, which will be flown to high altitude by balloon to photograph planets, nebulae and other celestial objects, is being constructed for Project Stratoscope II by Perkin-Elmer Corporation, Norwalk, Connecticut.

Purpose of Project Stratoscope is to loft high performance systems by unmanned balloon to high altitude above nearly all of the atmospheric turbulence and dust that distorts or obscures ground based observations. This permits much better resolution than possible from the ground.

(*Continued on page* 86)



New HF SSB Receiver heart of a whole new "state of the art"

New flexibility. Building block modules make the Westrex 600 receiving system the most versatile communications receiver. The RF, IF, AFC, synthesizer, test and power supply modules can be arranged in any manner dictated by user requirements. As an example, a typical 4-voice channel SSB circuit can be established using one RF and four IF modules. As many RF channels as required can be accommodated using fixed frequency or continuously tunable RF modules. Operation can be either "local" or "remote."

New high performance. Significant features are:

- Extremely low third-order distortion (85-90 db) is made possible by a breakthrough in receiver front-end design.
- The sensitivity is very high. Image and IF spurious rejection is excellent. The AGC is extremely flat over a range of 130 db.
- The SSB filters have exceptionally high performance with very low pass-band phase distortion and very steep selectivity skirts.
- Cast aluminum housings are used for the RF, IF, and synthesizer modules, keeping radiation to a fraction of common receiver values.

Learn more about this significant receiver development. Write or phone today.

Westrex Corporation

A DIVISION OF LITTON INDUSTRIES

Communications Equipment Department, Section 163

540 W. 58th St., New York 19, N. Y. 1625 I St., N.W., Wash. 6, D. C.

A TALENT FOR PULSE POWER MEASUREMENT

General Communication Company is currently producing PULSE POWER CALIBRATORS for military and industrial applications for laboratory and production line usage.

Model PCS-1B
Frequency Range: 925 mcs to 1225 mcs
Power Level Range: — 10 dbm to +63 dbm
Accuracy: 0.5 db

Model PCX-9
Frequency Range: 8500 mcs to 9600 mcs
Power Level Range: —5 dbm to +63 dbm
Accuracy: 0.5 db

The accuracy of this unique equipment is unprecedented for RF pulse measuring equipment. Measurements are accomplished at a fraction of the time with corresponding hourly rate savings. Neither of these equipments need another primary standard to prove the accuracy of its calibration. No additional components having unknown errors required. The answer obtained is final.
Similar equipment for other frequencies under development. We welcome your inquiries on this and other developments in the microwave field including microwave components, radar beacons and other specialized microwave test equipment.

See us at AFCEA, Shoreham Hotel, Washington, D. C., June 6-8, 1961, Booth No. S-283.

General Communication Company

677 BEACON STREET,
BOSTON 15, MASS.

creative electronics

News Items

The first test launch of the new system with a dummy payload is scheduled for sometime early this year.

The Stratoscope II telescope will be L-shaped, with one arm about 18 feet long. The telescope's primary mirror will be a 36-inch aperture, f/4, parabaloid. It will have a theoretical resolving power of 1/10 second of arc—equivalent to the ability to distinguish two objects 15 inches apart 500 miles away. The 400 pound primary mirror is fused silica, with its surface polished to an accuracy of 1/1,000,000th of an inch by Perkin-Elmer opticians. The mirror blank was produced by Corning Glass. This is the first time a quartz blank of this size has been successfully cast.

The secondary optical system, which relays and magnifies the image onto the photographic focal plane, will provide an effective focal length of 300 feet. Film used will be 70mm wide.

The telescope will be controlled and roughly pointed by command signals from observers on the ground, with final, precise pointing accomplished automatically by Perkin-Elmer designed sensing and control equipment in the telescope.

Project Stratoscope is directed by Professor Martin Schwarzschild of Princeton University. The program is sponsored by the Office of Naval Research and the National Science Foundation, with additional support by the National Aeronautics and Space Administration.

• • •

The Photo Instrumentation unit of Autonetics, a division of North American Aviation, Inc., has devised a method to reduce photographs to 1 per cent of their original sizes. The technique is being used to produce reticles (precision grids, scales, or patterns used in optical instruments or measuring devices). The department is using the same techniques in assisting in the pioneering of microminiature electronic systems.

To fulfill the micro-photographic assignment, Autonetics had to build its own special camera. Improvising as they went, the staff used the bellows from a standard camera, added and reversed the lens from a microscope for the lens, and devised their own negative holders. The Instrumentation unit may start with an architect's drawing of any size up to a 40-inch width, reducing it to five inches through use of a standard

(*Continued on page* 88)

Helping "man" the missiles at the Vandenberg Air Force Base is a new 3500-line automatic telephone intercommunications network installed by AE.

Advanced switching techniques permit this exchange to set up any desired combination of conference or command circuits in a matter of seconds, provide taping of conversations, and interconnect with outside lines via microwave.

Complex circuit routing such as this is not new with us—AE has had a hand in the development of specialized communications systems for the armed forces for over 50 years.

If you have a problem in communications or control, AE can usually supply the solution—as well as basic components or complete control systems. A letter or phone call (FIllmore 5-7111) to the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Illinois, will bring quick results.

AUTOMATIC ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

Stunt Box—your big plus with Teletype printers

Built into Teletype Model 28 page printers is a control device called the Stunt Box. The function of this unique component is to provide extra control facilities for both local and remote operations. Thus—in addition to transmitting, receiving and recording messages and data—the page printer can be used for a variety of switching, remote control and selective calling tasks.

The Stunt Box reduces costs by simplifying equipment needs and systems arrangements. It is the Big Plus—the extra value in Teletype Model 28 page printers and automatic send-receive sets.

Teletype Corporation manufactures this equipment for the Bell System and others who require the finest in data communications equipment.

Write for free 20-page brochure, "The Teletype 28 Stunt Box," to Teletype Corporation, Dept. 76C, 5555 Touhy Avenue, Skokie, Illinois.

TELETYPE®
CORPORATION • SUBSIDIARY OF *Western Electric Company* INC.

graphic arts process camera. The negative is then placed on the specially devised camera for further reduction.

• • •

Foto-Video Electronics, Inc. of Cedar Grove, N. J., has contracted with the Air Force to supply a closed-circuit television system for the Pentagon Air Force Headquarters. The contract involves the engineering, manufacturing and installation of a main studio with lighting, color and monochrome TV cameras and sound equipment, control apparatus, special effects generators, color film and slide cameras, color and monochrome monitors for previewing and line control operations. The equipment will include such units as color video tape recorders, color TV projectors for large-screen observation, multiplexers and camera heads for color slides and films.

Foto-Video Electronics is also a participant in the intercontinental B-52H-Skybolt ballistic missile combination production program as a supplier of television components both for the bomber and for the U. S. Air Force B-52H ground support bases.

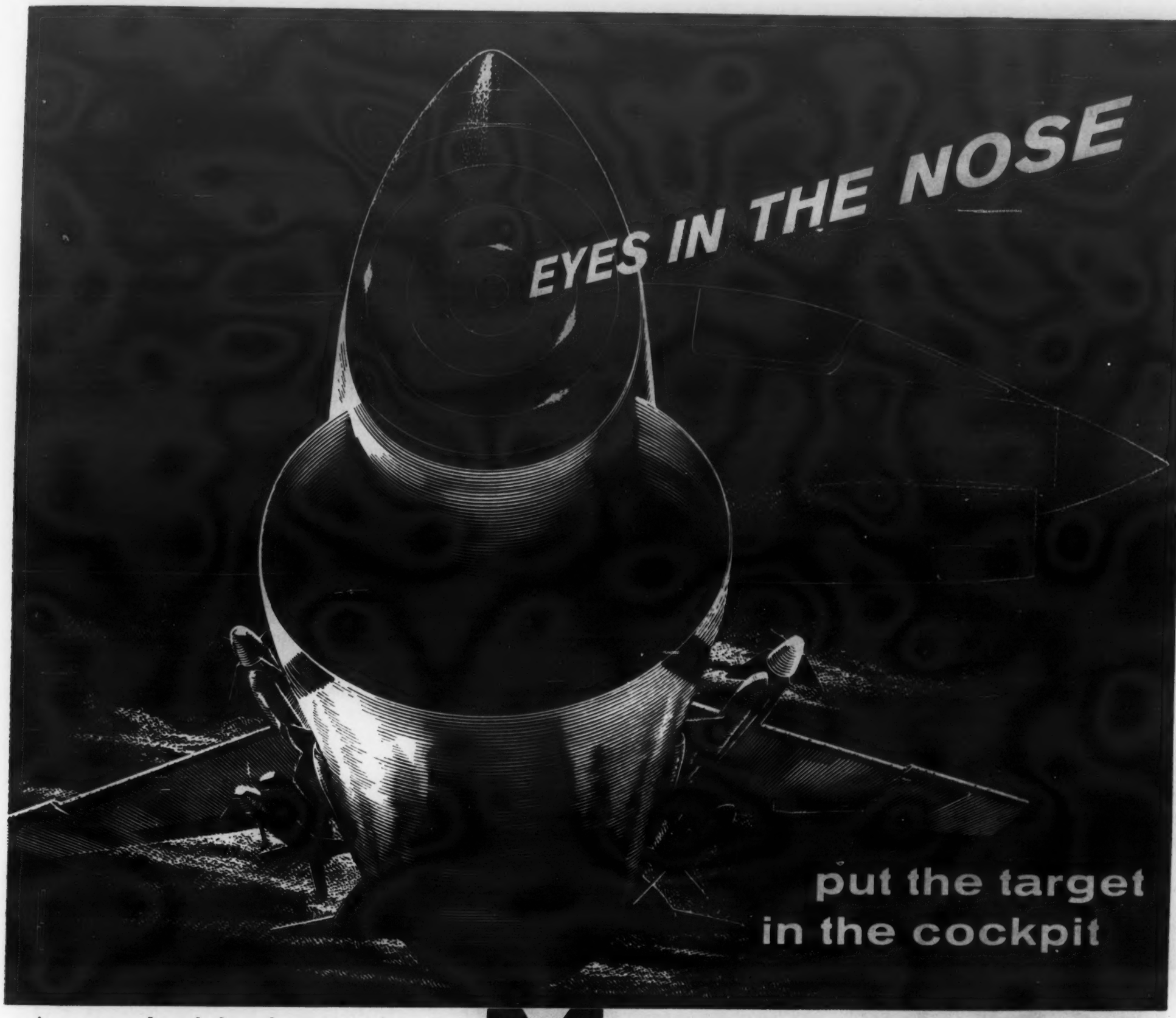
• • •

STL Products, a division of Space Technology Laboratories, Inc., has developed an electronic camera called the Image Converter Camera. STL describes the camera as the only complete diagnostic tool for instrumentation of high speed luminous transient events encountered in plasma physics, chemical kinetics and hypervelocity experiments.

The camera is capable of taking framed photographs at exposure times varying from three millimicroseconds to 200 millimicroseconds. Three-picture series can be made at rates of half a million to twenty million exposures per second. Streak photographs may be taken at writing speeds of four to 1,000 millimeters per microsecond. The performance of the camera is made possible by converting the optical image to an electron image which allows electronic shuttering, light amplification and image deflection.

Conversion of the light image into an electron image is accomplished by focusing the optical image on an image converter tube. The focused light strikes the photo cathode of the tube, thus effecting the conversion into an electron image. The electrons carrying the picture informa-

(*Continued on page* 90)

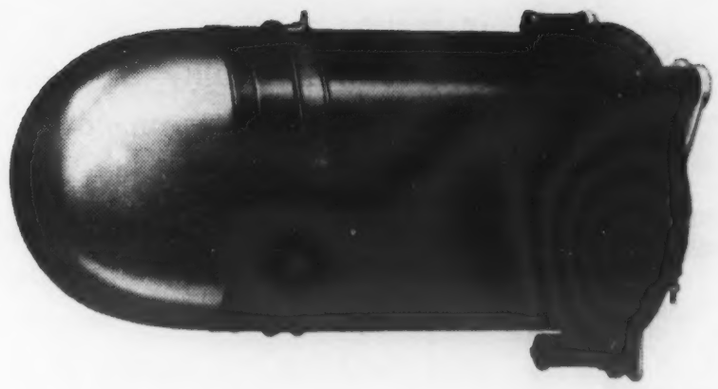


Magnavox

As a result of development by the Magnavox Company in conjunction with the Navy Department, every Chance Vought F8U-2N Crusader Fighter Pilot sees the target at a glance—day or night, in any kind of weather.

Here are the eyes of a modern weapons system . . . a component that delivers the range, weight and reliability so absolutely necessary to successful tactical operations.

This airborne radar system is just one of many systems which have been and are being designed and produced to satisfy the tactical requirements of the military services in the fields of Communications, Airborne Radar, ASW, Navigation, Fusing and Data Handling.



AIRBORNE FIRE CONTROL RADAR

COMMUNICATIONS | RADAR | DATA HANDLING | ASW | MISSILES

THE MAGNAVOX CO. • DEPT. 427 • *Government and Industrial Division* **• FORT WAYNE, IND.**

tion move toward the anode, where they cross over and are accelerated to a focus on a fluorescent screen at the end of the tube. The optical image is thus recreated at an amplified intensity on the screen. The amplified image on the screen is then focused on the film through a lens system and photographed by conventional means.

A gating grid, placed in the path of the electrons flowing toward the anode, serves as the electronic shutter by permitting or preventing the flow of electrons. Advanced circuit design provides a fast rising voltage pulse to the gating grid and thus the shutter speed is limited only by the parameters of the pulse forming circuitry. Varying the duration of the pulse provides a range of exposure times. Exposure times are changed by a switch on the control panel of the camera plug-in unit.

• • •

Photo-recording paper that can be developed by heat in three seconds was demonstrated recently in Philadelphia by Eastman Kodak Company.

A visible image forms on the paper with as little as 1½ seconds of development, the company reported. The silver-sensitized paper has chemicals for development incorporated in the photographic emulsion. Development begins as soon as heat is applied.

The new paper, called K-1549 is fast enough for exposure in oscillograph recorders with high intensity mercury lamps. Kodak indicated the paper is not intended for amateur or normal photographic use. Oscillograms made with the paper have remained readable for months under reasonably dry conditions. For greater permanence the prints may be stabilized or fixed by conventional methods.

• • •

High school students can enter their favorite pictures in the 1961 Kodak High School Photo Awards up to midnight of March 31. Topping the list of prizes totaling $11,750 are those of $400 to $300 in the black-and-white division, and $350 in the color section.

The competition is open to students in grades 9 through 12 who are in daily attendance at any high school in the United States or its territorial possessions. Color entries are eligible again this year and both prints and transparencies will be accepted. Black-and-white and color prints can be contact or wallet size, or enlargements up to 8 x 10 inches. Transparencies may be any size. There is no restriction as to type of camera or film and entrants can develop and print their own pictures or have them done commercially. Address entries and inquiries to Kodak High School Photo Awards, Rochester 4, N. Y.

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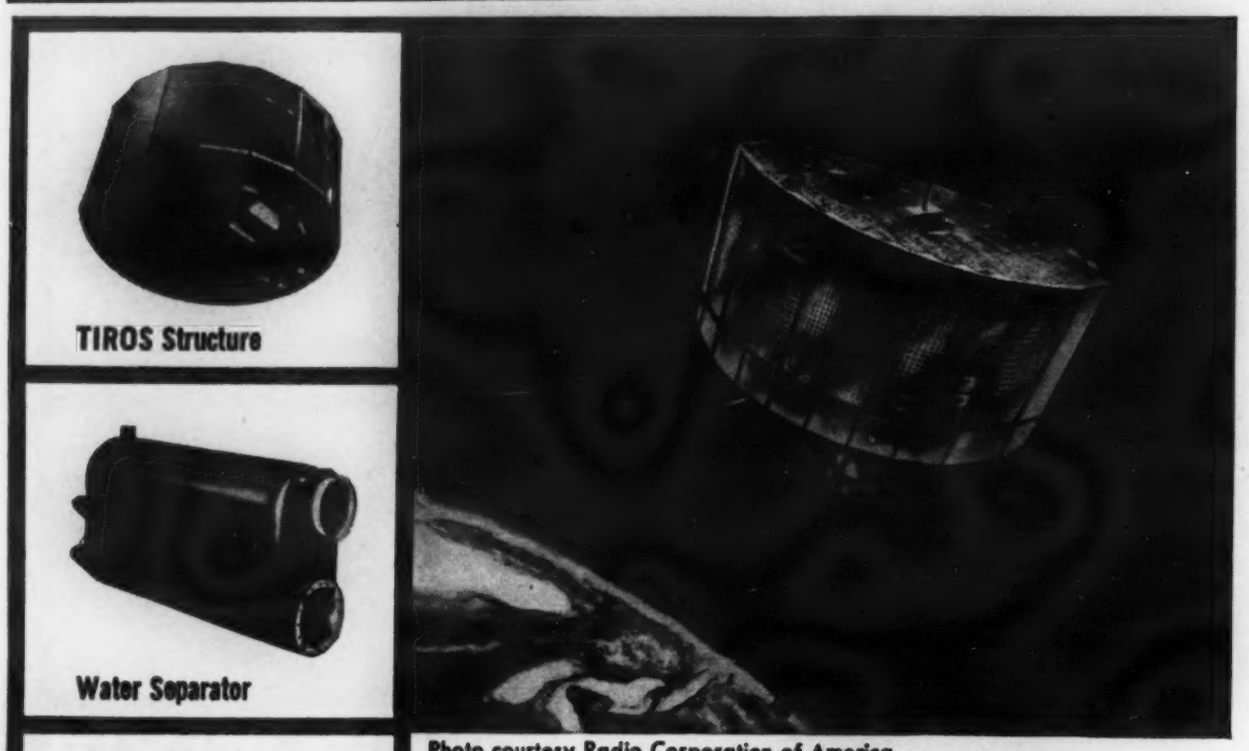
"The body of the lamp is a thick-walled cylinder with threaded cov-

(*Continued on page* 93)



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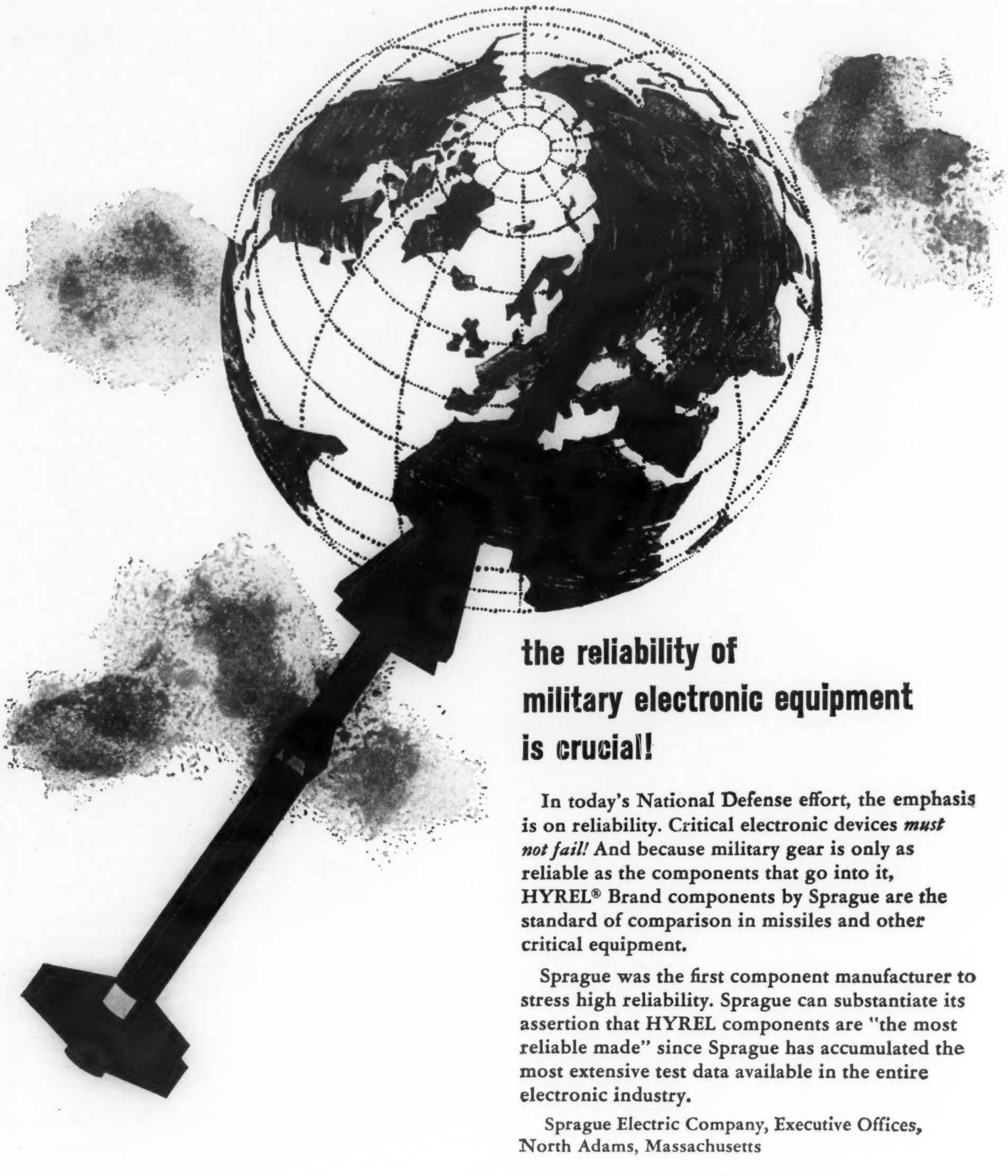

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(*Continued from page* 90)

ers. The tube is hermetically sealed by rubber gaskets. High voltage from a battery of ten 30 kv, 0.0025-μf capacitors is applied to a terminal. The discharge occurs between two needle-shaped electrodes located between fluorine plates which limit the discharge area.

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The above information was taken from *Current Review of the Soviet Technical Press* distributed by the Business and Defense Services Administration, Office of Technical Services, U. S. Department of Commerce. The original Soviet article is listed as Salamandra, G. D. and I. K. Sevastyanova in *Inzhenerno-fizicheskiy zhurnal*, vol. 3, No. 9, 1960.

Names in the News

Ernest L. Ward has been elected president of Sprague Electric Co.

Dr. Frank T. McClure, chairman of the Research Center, The Johns Hopkins University Applied Physics Laboratory, was presented an award for his invention of a Satellite Doppler Navigation System by NASA.

Lt. Col. Michael Bobela received the Air Force Commendation Medal. He is president of the Rome-Utica chapter of AFCEA.

John H. Boyle has been named general manager of the Collins Radio Company's new Communication and Data Processing Division.

Milburn B. Andrews has been elected vice president, marketing, for Space Electronics Systems, Inc.

Max Lehrer has been appointed director, Defense Business Development, Defense Electronic Products, Radio Corporation of America.

Homer R. Denius has been elected chairman of the board of Radiation, Inc. He will also retain the presidency.

Arthur F. R. Cotton has been promoted to vice president and managing director, International Operations, Capitol Radio Engineering Institute (CREI).

Gen. Nathan F. Twining, USAF (Ret.), formerly the Chairman of the Joint Chiefs of Staff, won the 1960 James Forrestal Memorial Award. Gen. Twining is an honorary life member of AFCEA.

Courtney Johnson, retiring assistant secretary of the Army for Logistics, has been elected president and director of Technical Industrial Consultants, Inc., Washington, D. C.

Dr. George B. Kistiakowsky, formerly special assistant for Science and Technology to President Eisenhower, was elected a director of Itek Corp. He will also be chairman of a new Itek Science Board.

Frank A. Gunther has been elected president of Radio Engineering Laboratories, Inc. (REL). He is a vice president of the New York chapter of AFCEA.

Edward G. Uhl was elected president of Fairchild Engine & Airplane Corp., Hagerstown, Md.

C. J. Harrison senior vice president of Rixon Electronics Inc., has been appointed chairman of the Small Business Committee of the Electronic Industries Association.

Col. Douglas O. Toft has been appointed Deputy Commanding Officer, U. S. Army Signal Supply Agency, Philadelphia, Pa.

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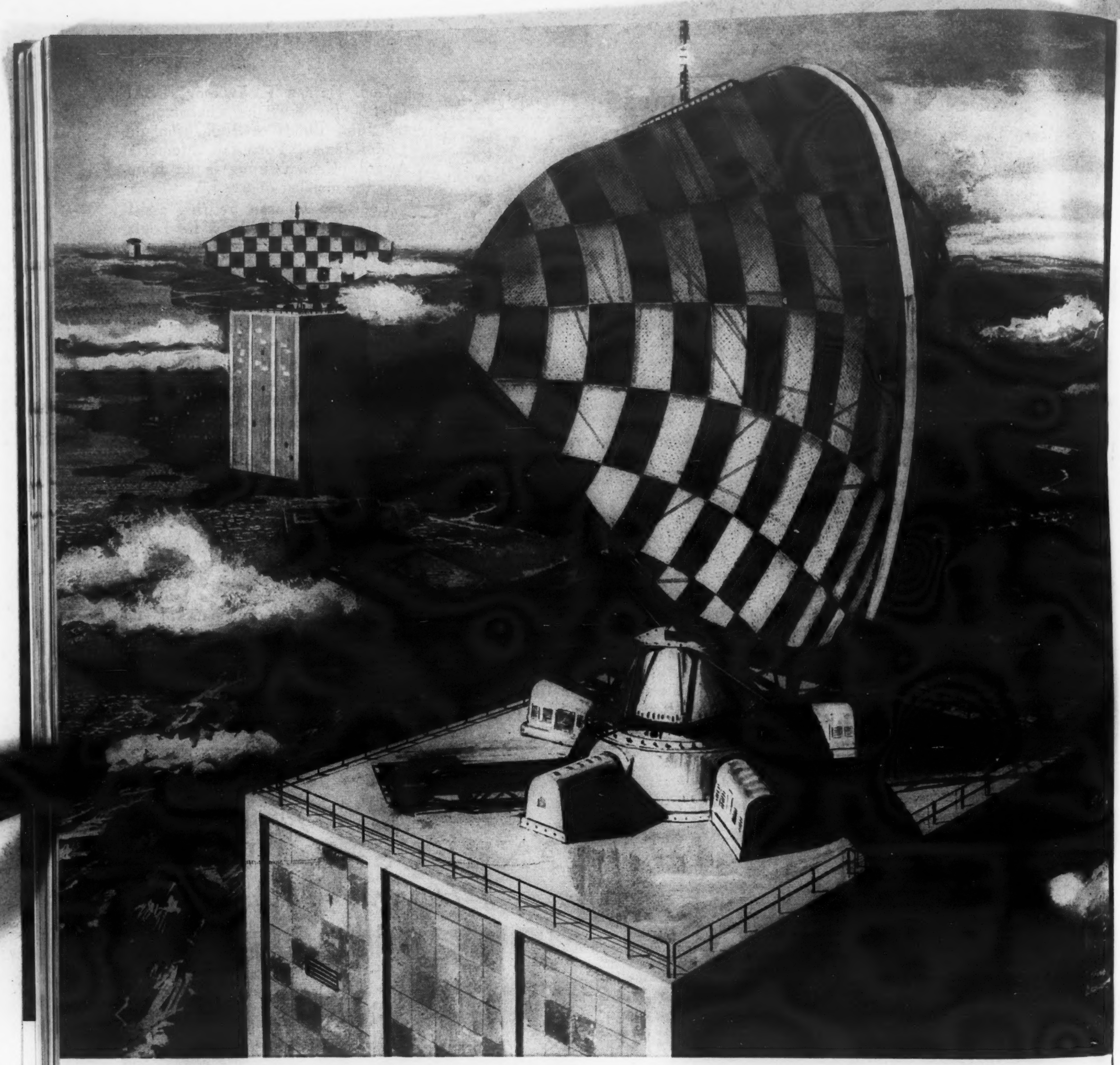

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As the number of television services grows, a better use of TV channels becomes increasingly important. TASO engineers first drew up specifications for measuring TV field strengths; then sifted data on field strengths of VHF and UHF. They have discovered reasons for hitherto unexplained deviations, and have also sought to establish a relation between field strength and picture quality.

How good are directional TV transmitting antennas? The results of extensive field tests are analyzed. To what extent do interfering signals and noise affect picture quality? How accurately can one predict an interfering field? These and other questions are answered.

So important are the TASO findings that IRE has allocated 120 pages to them. If you are not already an IRE member, we suggest you send in the coupon below to reserve a copy, for the June 1960 PROCEEDINGS will surely remain the definitive work on VHF and UHF TV for many years to come.

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"The Television Allocations Study Organization"—a Summary of its Objectives. Organization and Accomplishments" by George R. Town, exec. dir. of TASO; Iowa State University

"Measurement of Television Field Strengths in the VHF and UHF Bands" by H. T. Head, A. D. Ring and Associates; and Ogden L. Prestholdt, CBS-TV

"Forecasting Television Service Fields" by Alfred H. LaGrone, University of Texas

"Influence of Trees on Television Field Strengths at Ultra-High Frequencies" by H. T. Head

"Tropospheric Fields and their Long-Term Variability as reported by TASO" by Philip L. Rice, National Bureau of Standards

"Picture Quality—Procedures for Evaluating Subjective Effects of Interference" by G. L. Fredendall and W. L. Behrend, RCA Labs.

"Measurement of the Subjective Effects of Interference in Television Reception" by Charles E. Dean, Hazeltine Research Corp.

"Studies of Correlation between Picture Quality and Field Strength in the United States" by C. M. Braun and W. L. Hughes, Iowa State University

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"Findings of TASO Panel I on Television Transmitting Equipment" by H. G. Towlson of General Electric Co. and J. E. Young, RCA

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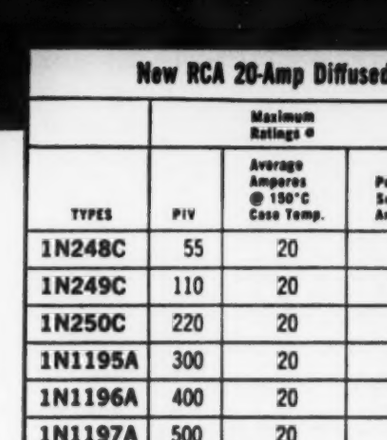

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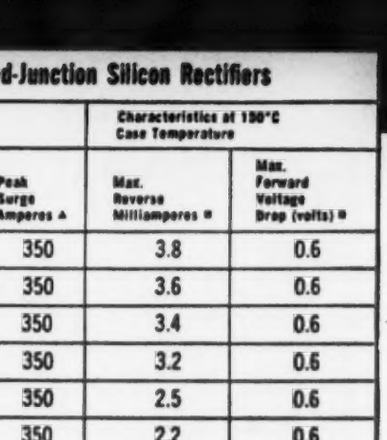

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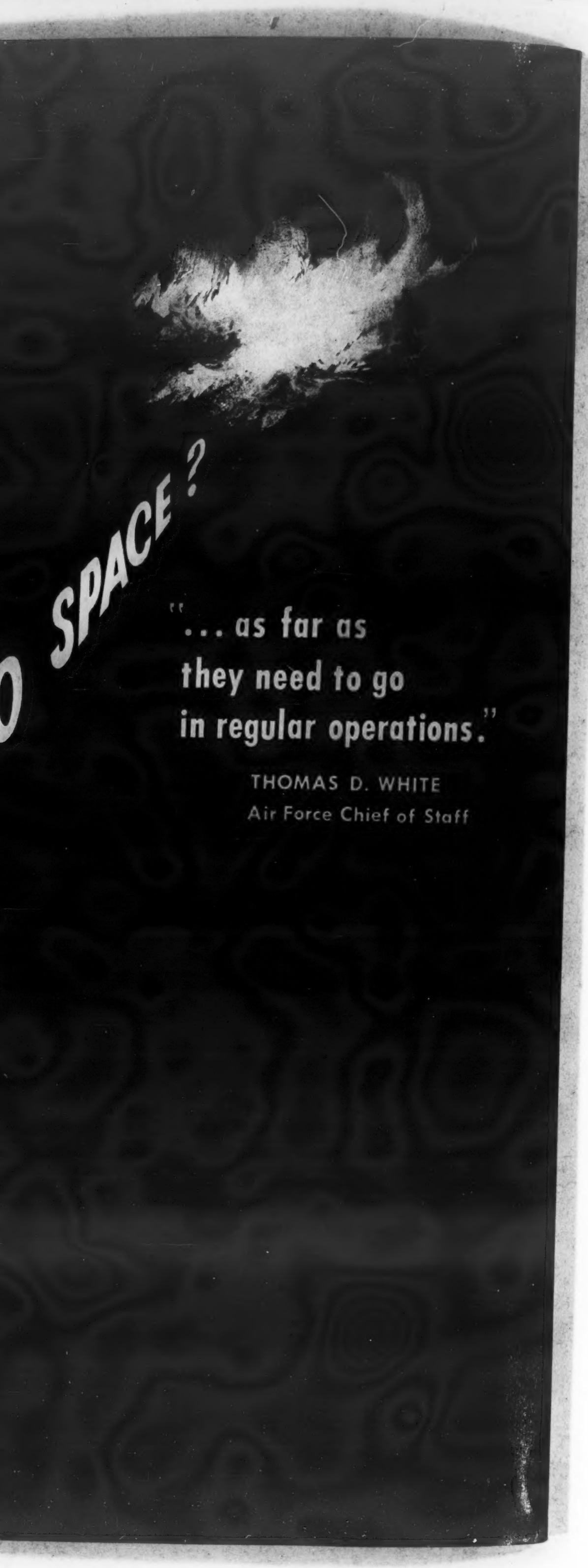

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